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C. C. Washburn

1945

PUBLICATIONS

OF THE

WASHBURN OBSERVATORY

OF THE

UNIVERSITY OF WISCONSIN.

VOL. I.

MADISON:
DAVID ATWOOD, STATE PRINTER.
1882.

WASHBURN OBSERVATORY.

FOUNDED BY

CADWALLADER C. WASHBURN.

BORN 1818; DIED 1882.

EDWARD S. HOLDEN,	. . . .	DIRECTOR.
SHERBURNE W. BURNHAM, GEORGE CARY COMSTOCK,	. . . . . .	ASTRONOMERS.
JOHN DOESCHER,	. . . .	JANITOR.

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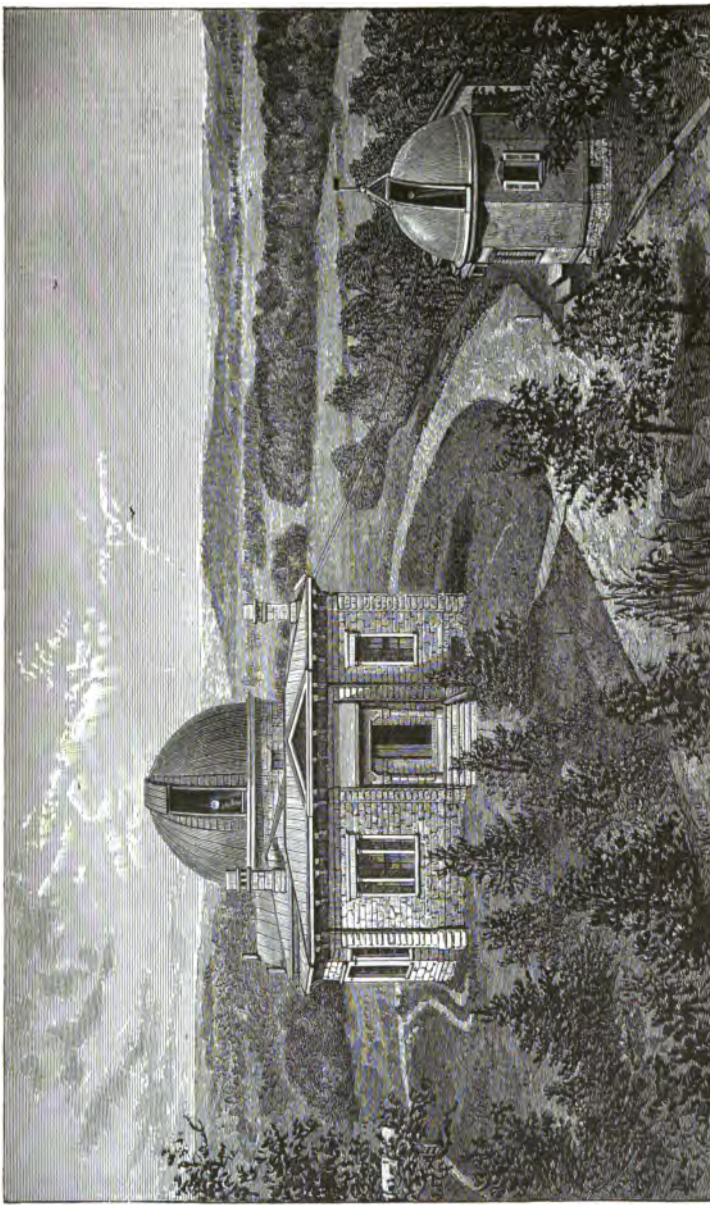

INTRODUCTORY NOTE.

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As no extended reports were required from the late Director during the progress of the building and equipment of the Observatory and before astronomical observations were begun, I have thought it my duty to present in my first annual report some connected account of the history of the Washburn Observatory from its foundation, including a brief description of its buildings and instruments.

In 1877 the Hon. C. C. WASHBURN announced to the Regents of the University of Wisconsin his intention to build and equip an astronomical observatory which was to be turned over to the University as an adjunct of the department of Astronomy. The gift was accepted by the Board of Regents, a site was selected by Governor WASHBURN, and the building commenced in May 1878. Orders for instruments were also given. In October 1878, Professor JAMES C. WATSON was elected Professor of Astronomy in the University and Director of the Observatory, and entered at once upon his duties. From this time until his premature death, in November 1880, Professor WATSON was chiefly occupied in completing the main building and in perfecting the interior arrangements, every part of which bears witness to his scrupulous and scientific care. Important additions to the Washburn Observatory were begun by his advice and according to his plans. Beside superintending every detail of these constructions, Professor WATSON was also occupied in building a solar observatory and a small observatory for students, both at his own expense.

From exposure in superintending work in the dwelling house of the Astronomer, Professor WATSON was taken ill on November 14 and died November 23, 1880, after a tenure of his office of only twenty-five months.

By his premature death a vacancy was created, which I have been called to fill. My first duty has been to collect the scattered

papers and computations left by Prof. WATSON and to present in this first number of the Publications of the Washburn Observatory some account of the preparations he was making for scientific activity. It is in this way only that his name can be associated with this Observatory, of which he was the first Director. No astronomical observations were made here by Prof. WATSON, of which I can find any record.

The present report contains:

I. A brief description of the Observatory buildings and instruments prepared by myself, with valuable assistance from Messrs. C. I. KING, G. C. COMSTOCK and F. D. WINKLEY of the University.

II. A catalogue of 195 stars, reduced by Mr. G. C. COMSTOCK, assistant in the Washburn Observatory.

III. Reduction Tables for the Latitude of Madison, computed under the direction of Prof. JAMES C. WATSON by Mr. G. C. COMSTOCK of the Washburn Observatory and Mr. J. M. SCHÆBERLE of the Detroit Observatory.

IV. A list of 27 new nebulæ discovered in the Zone Observations at the Washburn Observatory, from April 23 to September 30, 1881.

V. A list of 60 new double stars discovered in the Zone Observations at the Washburn Observatory, from April 23 to September 30, 1881.

VI. A list of 88 new double stars discovered at the Washburn Observatory, from April 23 to September 30, 1881, by Mr. S. W. BURNHAM.

VII. Measures of 152 double stars selected from his manuscript Catalogue of Double Stars, as specially needing observation, by Mr. S. W. BURNHAM.

VIII. Observations of 84 red stars, and a list of 27 new red stars.

IX. Observations and Drawings of the great comet of 1881.

X. Miscellaneous Observations.

It is hoped to continue this series of publications. It is requested that those scientific societies and individuals to whom this number is sent may return in exchange to the Library of the

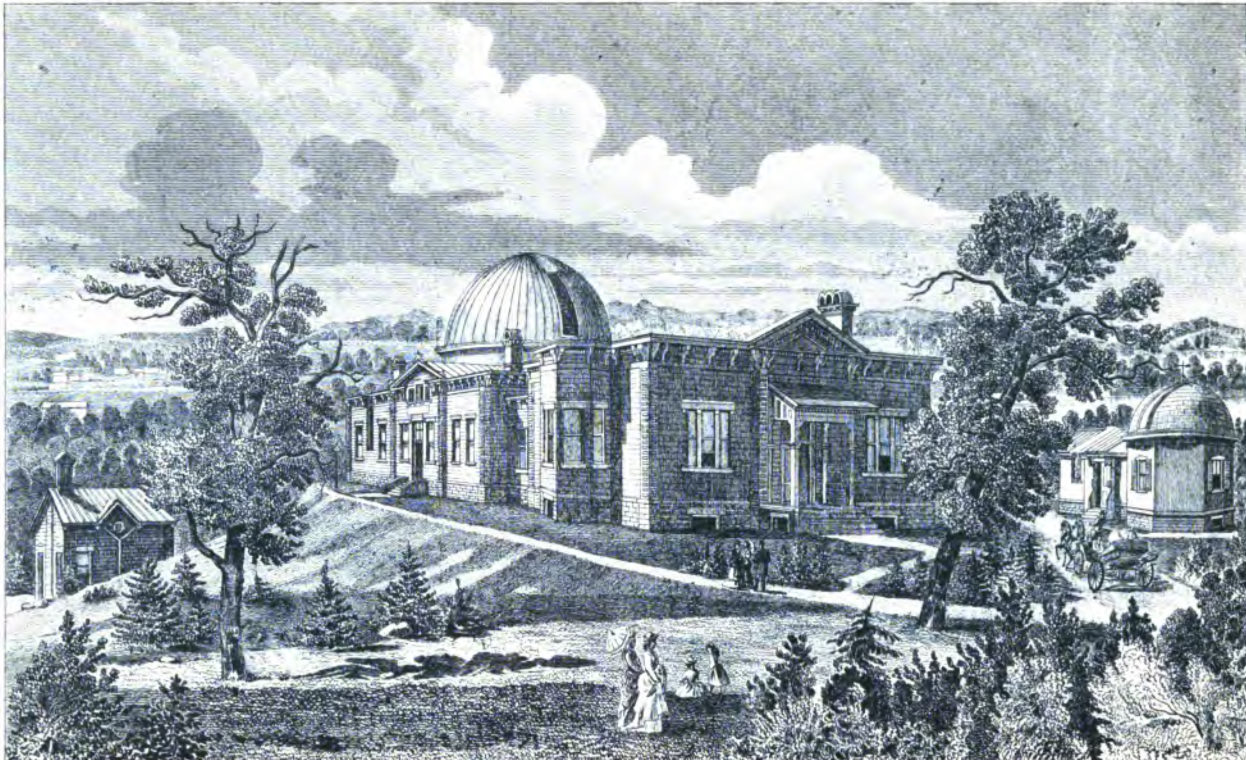
Washburn Observatory, such works as they have for distribution. And it should be remembered that as the Observatory is but newly founded, such exchanges need not be confined to volumes now current, but that back numbers of works, and separate memoirs will be gladly received.

The thanks of the Observatory are gratefully given to the many Societies and Astronomers who have already presented us with their publications. A special acknowledgment is due to Director OTTO VON STRUVE for the gift of a complete set of the Publications of the Pulkova Observatory; to the National Academy of Sciences for the loan of the scientific books of Professor WATSON'S library bequeathed to them; to the Directors of the U. S. Naval Observatory, the Observatory of Moscow, the American Ephemeris, the Nautical Almanac, the Berliner Jahrbuch, the Smithsonian Institution; to the Astronomer Royal and to the Council of the Royal Astronomical Society, for gifts of their publications.

In submitting this report I think it suitable to call the attention of those to whom it may come, to the fact that the entire Observatory, buildings instruments and equipment, is the gift of Governor WASHBURN to his adopted state, and to express my sincere pleasure in offering the present volume as an outcome of his enlightened and liberal views.

EDWARD S. HOLDEN.

MADISON, 1881 Sept. 30.



WASHBURN OBSERVATORY.

WASHBURN OBSERVATORY.

I. DESCRIPTION OF THE BUILDINGS AND INSTRUMENTS.

The site of the Observatory was selected by Hon. C. C. Washburn upon one of the hills of the University Park, about 2000 feet west of the entrance to the grounds, and about 100 feet above Lake Mendota, whose shores are only 700 feet away. There are few finer sites in the world for quiet beauty. To the north is Lake Mendota, some four miles wide and ten long, a beautiful basin with verdant banks usually sloping gently to the water, but in places high and bold. To the east lies the town of Madison, embowered in trees, and beyond the town Lake Monona. Between the Observatory and the town lies the University Park, with the College buildings and the *Campus* surrounded with fine trees. To the south, the country is lower than the Observatory site and is gently undulating to a range of hills some ten miles away. The view of the landscape to the west is shown in the frontispiece, which is a copy of a photograph taken from the top of the dwelling house of the Astronomer.

No better site could have been selected, situated as it is in the midst of a green plain, and protected on all sides from encroachments.

The Milwaukee & Saint Paul Railway tracks pass within 1200 feet of the main building, but so far no inconvenience has arisen from this source.

The Observatory itself is built upon the spot formerly occupied by an Indian mound, one of the many found in southern Wisconsin and the neighboring country. Two similar ones — effigy mounds — are now carefully preserved in the Observatory grounds a few hundred feet west of the meridian-circle room.

These are striking memorials of a race whose language even is

unknown, and they serve to show the kind of antiquities which the young communities[1] of the West afford. They should be sacredly preserved for present and future study, and they serve to point as sharp a contrast as the remains left by the Roman legions in their camps where the Observatory of Bonn now stands.

The summer climate of Madison is delightful, the winters are long and severe. The mean annual Temperature is 45.40° F., about that of Toronto, Canada.

	Feet.
The main floor of the Observatory is above the mean level of Lake Mendota	107
Lake Mendota above mean level of Lake Michigan	270
Lake Michigan above mean level of sea	581
Observatory floor above mean level of sea	958

The cistern of the Standard Barometer is 34 inches above the floor.

The cöordinates of the Washburn Observatory will be given for the centre of the mercury basin of the Meridian Circle Room. They are:—

Latitude ....

$$\varphi = 43^\circ\ 4'\ 36''.64$$
$$\varphi' = 42^\circ\ 53'\ 7''.5$$
$$\log \rho = 9.999325$$

Longitude: West from Greenwich .....
$$\begin{cases} \lambda = 89^\circ\ 24'\ 28''.31 \\ \quad = 5^h\ 57^m\ 37^s.89 \\ \quad = 5^h.96053 \end{cases}$$

West from Berlin ....
$$\begin{cases} \lambda = 102^\circ\ 48'\ 12''.0 \\ \quad = 6^h\ 51^m\ 12^s.80 \\ \quad = 6^h.85356 \end{cases}$$

West from Paris ....
$$\begin{cases} \lambda = 91^\circ\ 44'\ 37''.5 \\ \quad = 6^h\ 6^m\ 58^s.50 \\ \quad = 6^h.11625 \end{cases}$$

West from Washington.....
$$\begin{cases} \lambda = 12^\circ\ 21'\ 27''.0 \\ \quad = 0^h\ 49^m\ 25^s.80 \\ \quad = 0^h.82383 \end{cases}$$

West from Chicago.........
$$\begin{cases} \lambda = 1^\circ\ 47'\ 46''.6 \\ \quad = 0^h\ 7^m\ 11^s.11 \\ \quad = 0^h.11975 \end{cases}$$

[1] The first house in Madison was built in 1837.

This position rests upon measures made by the United States Coast and Geodetic Survey in 1873. A pier was set up by officers of the survey about 380 feet south and 1,830 feet east of the centre of the dome. This pier was connected by a survey made in 1879, with a small pier in the meridian of the west room and 60 feet north of the mercury basin.

The survey was made by Mr. G. C. COMSTOCK, assistant, and by two independent determinations he found:

Small pier *minus* Coast Survey pier: —

$$\Delta\varphi = +4.21''; \ \Delta\lambda = +25.05''.$$

The place of the Coast Survey pier has been kindly furnished me by Prof. J. E. HILGARD, and it is:[1]

$$\varphi = +43^\circ\ 4'\ 33''.03 \pm 0''.10,$$
$$\lambda = +89^\circ\ 24'\ 3''.26 \pm 0''.81.$$

The reduction from the small pier to the centre of the mercury basin of the Meridian Circle is

$$\Delta\varphi = -0''.60; \ \Delta\lambda = 0''.00.$$

Whence the position of the Washburn Observatory is

$$\varphi = +43^\circ\ 4'\ 36''.64,$$
$$\lambda = +89^\circ\ 24'\ 28''.31, \text{ W. of Greenwich.}$$

The centre of the 15-inch Equatorial is 11.8 feet north and 27.4 feet east of the assumed position of the Observatory, whence

$$\Delta\varphi = +0''.12; \ \Delta\lambda = \left.\begin{array}{l} -0''.37, \\ -0^s.02, \end{array}\right\}$$

And the coördinates of the Equatorial are

$$\varphi = +43^\circ\ 4'\ 36''.8; \ \lambda = +0^h\ 49^m\ 25^s.78.$$

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[1] The *latitude* of the Coast Survey pier was determined by the Zenith Telescope, C. S. No. 2, in August, 1873.

The *longitude* was determined by telegraph in July, 1873, and is referred to Omaha, Nebraska, the difference being:

Omaha — Madison = 26 m. 09s. 849 ± 0.024s.

This gives for the position of the Madison transit:

89° 24′ 3″ .15 ± 0″ .81, or, 5h. 57 m. 36 s. 210 ± 0.054s.

This transit was 7 feet 11 inches, or 0″ .11, east of the Coast Survey pier with which the Washburn Observatory was connected.

The centre of the transit pier of the Students' Observatory is 82 feet north and 198 feet east of the assumed position, whence

$$\Delta\varphi = +0''.81 \text{ and } \Delta\lambda = -2''.67, \\ = -0^s.18,$$

And the coördinates of the FAUTH transit are then

$$\varphi = +43^\circ\ 4'\ 37''.45;\ \lambda = +0^h\ 49^m\ 25^s.62.$$

I may mention, as a check, that an uncompleted series of latitude observations by Mr. COMSTOCK on 26 pairs of stars in three nights in August, 1881, gives for this latitude

$$\varphi = +43^\circ\ 4'\ 37''.74 \pm 0''.17.$$

For convenience I add here a few measurements of distances which I have found in a memorandum by Prof. WATSON:

	Rods.
Least distance between the dwelling house of the Director and the Observatory	15
From dwelling house to lake shore	33
From Observatory to lake shore	39
From dwelling house to University Hall	57
Nearest approach of the tracks of the Milwaukee & St. Paul R. R. to the Observatory	71.2
From Observatory to University Hall	74
From Observatory to Science Hall	107
From Observatory gas meter to Science Hall	128
From Observatory gas meter to main gas pipe at the head of State street	149

The Hospital for the Insane is situated north of the Observatory on the further side of Lake Mendota. Its central tower is 2952.7 feet *east* and 20589.1 feet *north* of the centre of the large dome of the Washburn Observatory, the distance being 20799.7 feet. One second of arc at this distance is 1.30 inches. For the coast survey data from which this is computed I am indebted to Prof. J. E. DAVIES, of the University.

DESCRIPTION OF THE BUILDING.

The observatory as originally built consisted of a dome, a centre hall and two rooms, one east, the other west of the dome.

The *west room* is destined to contain the meridian circle. It is 22 feet 4 inches (east and west) by 20 feet (north and south) in

interior dimensions, and is 13¾ feet high. The *east room* contains the clocks, chronometer, chronographs, and smaller apparatus. It is of the same dimensions as the west room.

Each of these rooms opens into the *main hall* which is 28 feet 8 inches in its longest dimension (east and west). Into this hall the main (south) door of the observatory opens, and this hall also contains the stair-way leading to the dome in the second story. The south wall of this space is a straight line 28 feet 8 inches long. The east and west walls are straight lines, each 14 feet long. In these walls the doors to the west and east rooms are cut. The north wall of this hall-way is the arc of the circle formed by the foundations for the walls of the dome. The least width of the hall, measured from north to south, is 8 feet 4 inches.

The large dome is on the second floor. Under it is a circular room 27 feet in diameter, containing the pier to the 15½ inch equatorial, closets for tools, lamps, etc., and a stair-way to the cellar. The centre of this room is in the line of the north walls of the meridian room and of the clock room.

Where the pier passes through the floor of this room, the dimensions of the pier are about 8 feet by 11 feet.

A door connects this room with the main hall, and another door leads to the west room.

Ascending the stairs from the main hall, a small hall is reached on the second floor, about 9 feet by 8 feet 6 inches in area. On each side of this hall are two large closets. The east closet has been fitted up with shelves for tools, etc. From the small hall the dome is entered directly. It is about 26 feet 9 inches in diameter and contains the 15½ inch equatorial with its pier.

An east wing to the Observatory was begun by Governor Washburn in 1879 and was to have been finished under the supervision of Professor Watson by December 1, 1880. This wing was completed in the spring of 1881.

It consists of a well lighted basement about 10 feet high, which contains the steam heating apparatus, the coal room, the galvanic batteries, a water closet, store rooms, etc., and of a one story building above this.

A door in the east wall of the clock room opens into a hall

8 feet 6 inches wide (north and south) by 21 feet long (east and west). This hall contains the electric apparatus, telegraphic switch board, telephone, etc. A door in its northeast corner gives access to a covered porch and an exit from the building. A second door at its east end leads into the *Library*. This room is 24 feet (east and west) by 21 feet (north and south), with a bay-window at its south end. It serves as a library room and also as the office of the Director. It has shelf room for about 1000 octavo books, and is provided with 18 drawers for keeping pamphlets on the plan described by me in the *American Library Journal*, 1880, vol. V, page 166.

A door in the northeast corner of the library gives access to the *east hall* 12 feet 4 inches (east and west) by 10 feet (north and south) and an exit from the building. The *janitor's room*, 13 feet (east and west) by 10 feet (north and south) opens into this hall and is directly west of it.

The north room of the east wing was designed by Prof. WATSON as a computing room. It will be used as a bed room for an assistant. It is 12 feet (north and south) by 24 feet (east and west) and extends completely across the east wing. A door gives access to the east hall, and a second door opening on the porch gives an independent exit from the building.

From the porch which has been mentioned stairs lead directly to the cellar of the Observotory.

All the rooms of the east wing as well as the clock room in the main building are warmed by the steam heating apparatus. The Observatory is supplied with water from a reservoir on the college building. Gas is provided throughout the Washburn Observatory. The Students and Solar Observatory are lighted with lamps.

The material of which the exterior walls of the Observatory is built is the yellow Madison stone. The porch of the east wing is of Lake Superior sandstone (red) and of Joliet stone (white).

The roofs are of tin painted, the cornices of wood and iron, the whole having a pleasing architectural effect. The designs were made by D. R. JONES, Esq., of Madison.

A more detailed description of the separate rooms is given whenever it is necessary, in the following pages.

FOUNDATIONS.

Originally the main building had no cellar, and one of the first works undertaken by Prof. WATSON was to dig a cellar under the dome, main hall and east and west rooms. This cellar is only for purposes of ventilation, etc., and is made to connect with the basement of the east wing.

From a memorandum of Prof. WATSON's made October 16th, 1879, I learn that the foundation walls of the original building are 4½ feet below the surface of the ground.

The foundations of the tower of the dome are 5½ feet below ground, and the foundation of the pier of the 15½ inch equatorial is about 8 feet 5 inches below the original surface of the ground.

The hill on which the Observatory stands is largely composed of a layer of building sand which extends to a considerable depth and serves as an admirable basis.

THE WEST ROOM (Meridian Circle).

The west room is 22 feet 4 inches (east and west) by 20 feet (north and south), and 13 feet 9 inches high to the flat ceiling. A slit 25 inches wide is closed by two counterpoised shutters on the sloping roof (the ridge-line running east and west), and by four pairs of vertical shutters, two north and two south.

The ridge-line is 140 inches higher than the flat ceiling; the eaves being 66 inches higher. The space above the ceiling serves as an air space to keep the room cool, and the sides of the slit are not ceiled up, as is usual, but they are covered with wire netting on both sides of the slit, so as to allow a free circulation of air. This arrangement is, I believe, first carried out at the Washburn Observatory. Ventilators in the walls allow of changing the air.

Prof. WATSON had mounted in this room a 6-inch meridian transit instrument, made by PISTOR & MARTINS in 1856, for the United States Coast Survey. This instrument was his own private property, and it is to be replaced by a four and one-half inch meridian circle ordered from REPSOLD BROTHERS., of Hamburg, early in 1881, by Governor WASHBURN. This meridian circle is to be similar to that made by the Messrs. REPSOLD for the Strassburg Observatory.

The arrangement of the shutters in this room will need some changes for convenient working, and new piers are required.

The foundation of the pier of the transit circle is made in one block, with piers for collimators north and south.

THE EAST ROOM (Clock Room).

The east room is 22 feet 4 inches (east and west) by 20 feet (north and south) and 13 feet 9 inches high. It has two windows north and two south. Between the two south windows is the sidereal clock HÖHWŮ No. 32, ordered by Prof. WATSON and mounted by me in April 1881. On the north side is the THOMAS mean time clock. Both of these clocks are on piers of sandstone 67.5 inches high, 17.25 inches wide at top and 25.50 inches at bottom. The top thickness of these piers is 15 inches, the bottom 20 inches. The pier of the sidereal clock is made of 5 stones, cemented together. The bottom stone rests on a stone base 30 inches wide, by 10 inches high by 24 deep. This base rests on a foundation of white Waterloo brick laid in cement. The pier of the mean time clock is a single shaft.

The Sidereal clock with its pier is enclosed in a wooden closet with a plate glass front, which projects into the room.

The chronometers BLISS No. 2791 (break-circuit, sidereal) and BLISS No. 2786 (sidereal) are kept in a lined case in this room, and the chronograph by FAUTH & Co., of Washington, is also mounted here. All electric connecting wires go direct from clocks, chronograph, keys, etc., to the switch board, in the hall next the clock room.

THE SIDEREAL CLOCK.

The escapment of this clock is the dead beat and it is, I believe in all respects similar to the excellent clocks made by HERR HÖHWŮ for the observatories of Leyden, Strassburg, etc.[1]

No detailed description of it is necessary. Its performance so far has been good. The compensation is mercurial.

It is provided with an attachment for sending an electric current every two seconds to a chronograph or sounder. On the

[1] *Leyden Observations*, Vol. 1, p. LVIII and *Astronomische Nachrichten* No. 1502.

right hand side of the pendulum at the top is attached a little arm carrying a Y. In this Y the arm of a small platinum disc rests; the disc itself being supported by an ivory point fixed to the clock case. As the pendulum swings this disc is alternately raised and lowered, and it can be made to touch two platinum points at every oscillation.

When these points are so touched, a current from a battery of two LECLANCHÉ cells passes through a relay magnet *inside* the clock case and thus an alternating current is produced which can be led to the chronograph, sounder, etc., through a battery and key.

I have found this arrangement too delicate and too easily disturbed for general use. If this form of attachment is to be retained, the clock relay should at least be placed *outside* of the clock case, where the adjusting screws for bringing the platinum points into contact can be reached without taking off the hood, or top section of the clock case.

In my opinion a much better arrangement is to fasten a platinum knife about midway of the pendulum rod and to allow this knife to cut through a globule of mercury every second. The interrupted current so obtained can now be led to a relay and from the relay to the chronograph, etc.

The HÖWHU clock will find its chief use as the normal clock of the Observatory, and the Break Circuit Chronometer will be used for making the actual chronographic signals. In this way, we may look to its best performance undisturbed by any extraneous work.

THE MEAN TIME CLOCK.

A mean time clock, by S. THOMAS' SONS, New York, is mounted on the north clock pier. It is connected with the switch board. It is kept running on *Chicago* mean time, which is practically the standard time of the whole state of Wisconsin. It has a gridiron pendulum of zinc and steel. The Pendulum Bob is of lead, 8 inches high by 2.5 inches in diameter. It weighs 16 pounds. The escapement is dead beat. The seconds are marked by a "sweep seconds hand." So far the performance of the clock has not been entirely satisfactory.

THE CHRONOGRAPH.

A chronograph has been furnished by Messrs. FAUTH & Co., of Washington. The accompanying cut, which has been kindly given me by them, will give a better idea of it than any description. Its cost is only $325, and its performance is perfectly satisfactory.

THE TOWER CLOCK.

Besides the two astronomical clocks of the Observatory, the University also owns an excellent 8-day tower clock (No. 171) made by SETH THOMAS' SONS, of New York. This clock is mounted in the tower of Assembly Hall, about 2000 feet east of the Observatory.

By means of four outside dials (capable of illumination at night) it shows the Chicago mean time to the nearest minute. (Chicago is $7^m\ 11^s.11$ east of Madison.)

A wood cut of this clock from an electrotype kindly furnished by the makers, is given herewith.

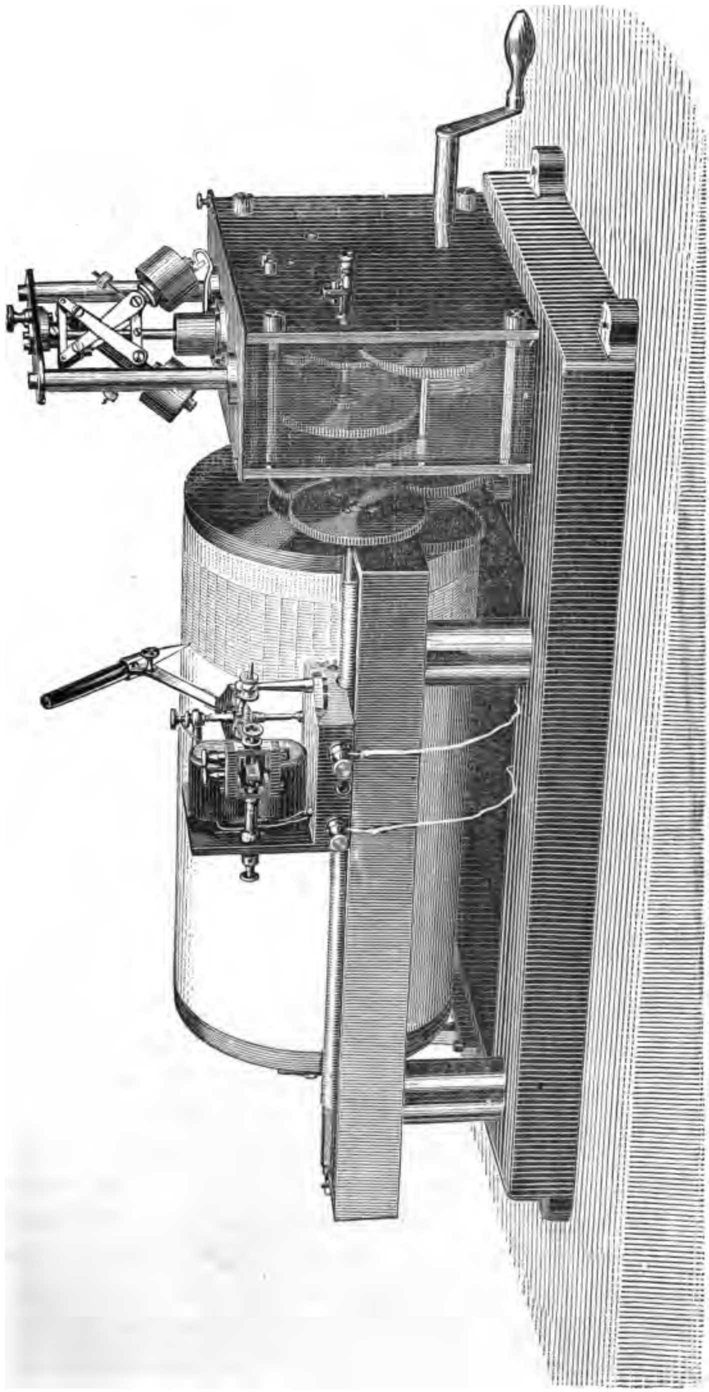
It will be seen that the escapement is the double-three-legged gravity escapement of DENISON. The compensation is zinc and steel.

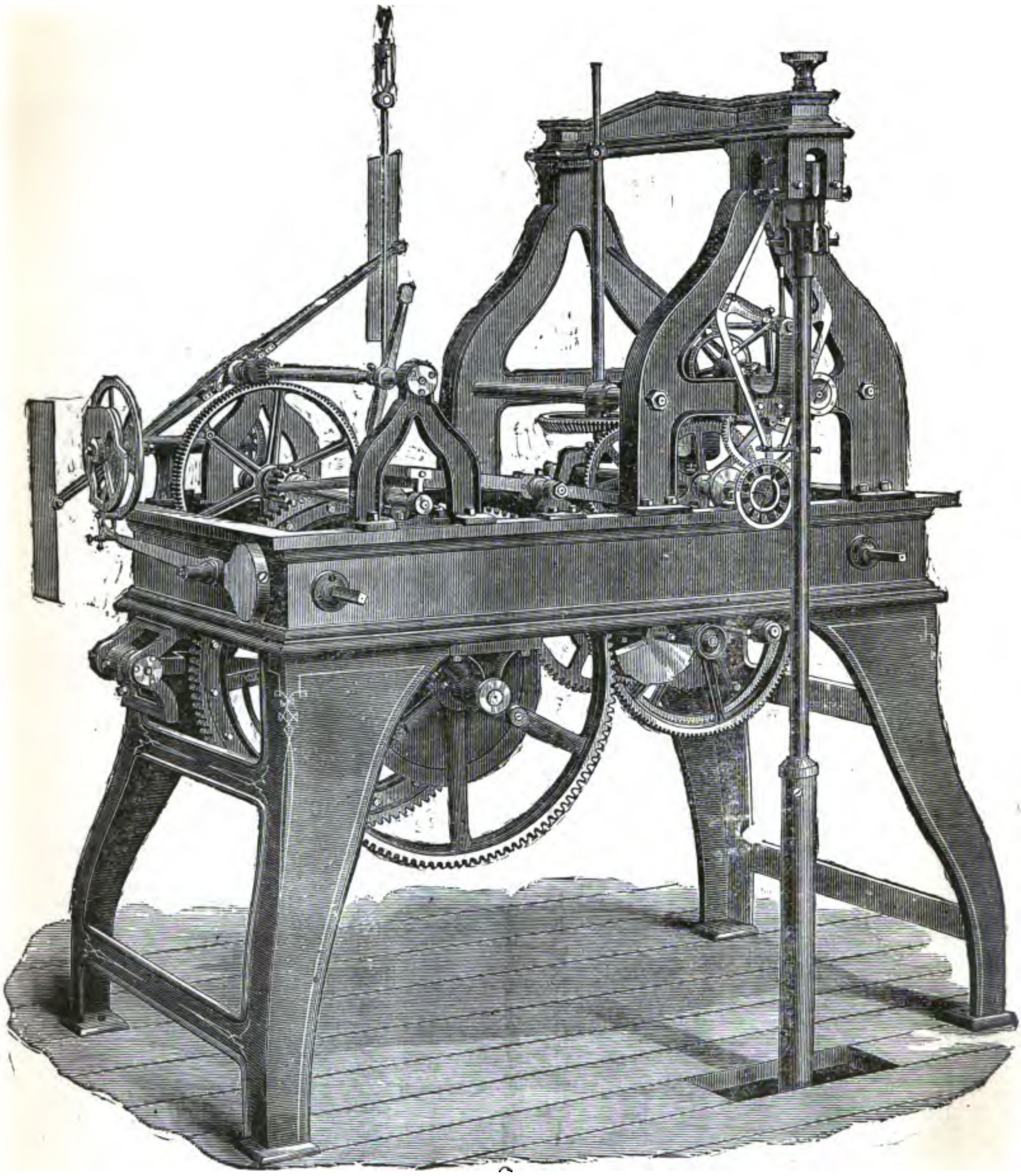
The pendulum with its bob weighs about 460 pounds and oscillates once in 2^s. The striking weight is about 1500 pounds, of which only about 400 pounds is directly on the movement.

The weight on the time side is from 275 to 300 pounds. The main strike-wheel is 24 inches in diameter with 20 steel cams to raise the hammer. The main time-wheel is 16 inches in diameter. The wheels throughout are bronze, the pinions being of steel.

The clock is as well mounted as the construction of the tower will admit of. The movement itself is in a room separated by walls either of masonry or glass from the rest of the tower. The pendulum passes below the floor and from thence through a rough box to a glass case in the entrance hall of the building, which can be opened to adjust the regulating nut at the bottom.

It was intended by Professor WATSON to have this clock electrically connected with the Observatory, so that it should make circuit at each swing of the pendulum. As however, the difficul-





ties of such a connection are much increased when a pendulum swings very slowly, and as after all the only use of such a connection was for the purpose of readily comparing the clock, I have introduced a much simpler device which, after trial, has proved completely satisfactory.

A single telegraph wire was led on poles from the Observatory to the clock, with a ground connection at each end. In the circuit at the clock an ordinary microphone (BLAKE-transmitter), kindly loaned to the Observatory by the American Bell Telephone Company, was put through a four-pointed switch at the Observatory; our telephone can be thrown into the clock circuit, and inserting the wedge "Tower-Clock" in any of the spring jacks of the switch board, a battery (usually of one or two standard DANIELL'S cells) is also brought into circuit.

When this is done the beats of the clock (every 2 seconds) can be distinctly heard. If we have the means of identifying the beginning of each minute, we have the means of making accurate comparisons between the Tower clock (error and rate unknown) and any of the Observatory clocks.

This has been accomplished in a very simple way as follows: on the wheel which moves the second hand (which revolves in one minute), a brass disc about 2 inches in diameter, which revolves with it has been put. Near the outer edge of this disc is a steel pin. Six seconds before the beginning of each minute this pin picks up the short end of a lever some 5 inches long and raises the hammer end during 6 seconds. Exactly at 60 seconds the pin releases the hammer, which falls through about ½ of an inch upon a small bell. This sound is distinctly heard through the telephone, and fixes the beginning of each minute. The minute is never doubtful and consequently we have all the elements for rating this clock. Our observations indicate that some changes in the compensatiou are necessary.

ELECTRIC CONNECTIONS.

The system of electric connections, etc., used here, is copied from that introduced by Prof. JOSEPH WINLOCK at the Harvard College Observatory, and described (with plates) in the *Annals* of

that Observatory, Vol. VIII, page 22. The system for the Washburn Observatory was worked out in a complete manner by Mr. WILLIAM C. WINLOCK, of the Naval Observatory, to whom I express my obligations. The battery room is the northeast room of the cellar, and is warmed by the smoke flue of the steam heater. From this room the battery wires are led to the switch board and terminate in spring jacks. Pairs of wires are led from each key, clock and chronograph, through the cellar to the switch board and terminate in wedges. The wires for the clocks have a brown cover to the insulation; chronograph wires have blue and white covering, and key wires have blue covering. Thus any circuit can be quickly traced and followed.

Each key, clock or chronograph circuit terminates at the switch board in a wedge, marked plainly with its name. To connect any key with any clock the wedges of the two have to be placed under the same spring-jack, which then sends its battery current through key and clock. Outside lines are led as follows:

(A.) A telephone line to the south of the Observatory and to the central office of the telephone company.

(B.) A Western-Union loop to the south of the Observatory along the poles of the Western Union Telegraph Company (by their kind permission), near the tracks of the Milwaukee & St. Paul R. R. Co., into the main office of the telegraph company in Madison.

(C.) A line of single wire to the tower clock on Assembly Hall.

(D.) A double line to the Student's Observatory.

(E.) A short single line to the Astronomer's house.

The whole equipment of lines C, D, E, belongs to the Observatory. Lines A and B are both run on one set of poles to the junction with the Western Union poles, and to this point the poles and lines belong to the observatory. Beyond this point the poles and wire of line A belong to the Bell Telephone Co. The wire of line B belongs to the Observatory, the poles being as was said the property of the Telegraph Company.

It should be added that the resistance of the main line relay is 250 Ohms, while the resistances of the two clock relays, of the sounder and of the (rewound) chronograph magnet are 5 Ohms each.

CONSTRUCTION OF THE DOME.[1]

"The dome is 30 feet 2 inches internal diameter, and is of wood. A series of ribs radiate from the vertex of the hemisphere and terminate on oak plates which carry the upper track. These ribs are of pine, built up from inch lumber; they are 4 inches by 8 inches and 2 feet apart at the base.

The outside of the dome was covered with a thin sheeting of pine and finally tinned; the inside was finished with well oiled canvass, which was well stretched, shellacked and painted. For 2 feet above the oak plates the ribs are vertical, thereby forming a cylinder, from which the hemisphere proper begins. The slit for observation is 4½ feet wide, 25 feet long and extends 2 feet beyond the zenith. The shutters are fitted with iron rolls having plane faces, experiment showing them to move easier than with the usual grooved wheel. The track is of ¾ inch half-round iron.

The shutters were made in two pieces; the upper one was 16 feet long, and the lower one 9 feet.

They are both operated from one rope and wheel, which are carried by the dome, and are entirely independent of any of the stationary parts. Therefore the dome may be turned at all times without a preliminary detaching of ropes, etc.

By this arrangement only part of the slit could be uncovered at a time, and in 1881 the lower shutters were replaced by a pair of doors which are shown in the full page view of the dome and equatorial. These were devised and fitted by Mr. WINKLEY.

THE MECHANICAL APPARATUS OF THE DOME.

"The construction of the machinery for revolving the dome was commenced in the fall of 1878. Before any real work was done several Observatories were inspected, and it was learned that while all possessed good devices, none were entirely satisfactory,

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[1] The following account of the construction and machinery of the dome has been written by Mr. C. I. KING, under whose charge nearly all this work has been done in the University machine shops.

I desire to express my obligations for this description which has purposely been made quite full in order that the admirable features of our dome may be available to those engaged in building such structures.

owing principally to poor mechanical work in detail, and it was decided that a planed track and cut gearing were necessary as a first improvement.

The dome and track rest on oak plates 4 inches by 8 inches. These plates rest on the cylindrical stone wall forming the tower, and are secured in position by 1 inch bolts 4 feet long, which extend down in the wall to a chamber made to receive a washer of sufficient area so that the stone or mason work should not be crushed by pressure in screwing up.

These oak plates are in 6 foot sections, and the sections of the iron track are the same length. They are so placed that the ends join in the middle of the wood sections, thus breaking joints and securing nearly the equivalent of a continuous ring. In placing the plates and track in position, a trammel was used to bring the plates in a plane and the track to a cylinder. This tram was mounted on the pier which afterwards received the telescope; by its use a much closer approximation to the plane and cylinder were obtained than by the usual methods.

The tracks are made of cast iron and were planed on both top and bottom. A transverse section will be seen in the plate at A. A. The outer track is slightly lower than the inner one to accommodate the form of the rollers. These rollers, 16 in number, were all carefully turned and are simple frustrums with flanges at each end, and once placed in position with their axes on radiating lines, they would theoretically have no tendency to end travel.

These rollers are maintained in their relative positions by what is commonly termed a "live ring." It is formed of two rings with distance enough between to admit the rollers, whose axis passes through each ring. They are carried by a 1¼ inch shaft. The ring is of 3 inches by ⅝ inches iron and the outer and inner parts are each in two sections to facilitate transportation and placing in position.

The upper track is a counterpart of the lower one, except that the oak plates sustain the large internal spur gear wheel by which motion is communicated to the dome. The inner edges of these plates were very carefully dressed and by aid of the tram when

placing the rack segments of which this gear is composed, a true cylinder was obtained.

These racks have cut teeth of 1½ inch circular pitch, with 3 inches face; the whole wheel contains 750 teeth, and is 29 feet 9 inches diameter on the pitch line.

It was in the beginning determined to avoid the bevel wheels and racks so commonly used for this purpose, and to have cut gearing throughout. It is without question to these precautions, that the good results afterward obtained were due.

The general arrangement of gearing is shown at B, C and D in the plate. B is an end section of the rack; C, C,′ C,″ are spur wheels in connection with it by a system of bevel wheels at the lower side of the two vertical shafts. It was endeavored to communicate motion to the opposite diameter of the dome, and so counteract the tendency of the gearings, to push the dome against the roller flanges.

The value of this arrangement remains to be proven. In a properly constructed tower, recesses might be made in the wall to receive the vertical shaft, and thereby avoid the short shafts and the wheels C, C,′ C.″

Motion is communicated to the dome at E, through the usual crank and lever wheels. They are geared in the proportion of 3 to 1.

During the first trials of the machinery, 16 to 32 pounds pressure on the crank would start the dome in motion, and 8 to 16 pounds would sustain it.

The approximate weight is 14 tons; 96 turns of the crank produce one revolution of the dome.

For convenience in turning the dome through small angles, an additional crank-wheel has been fitted, which is geared in the proportion of 9 to 1.

The shutters are opened and closed by two parallel wire ropes which pass up on the edges of the slit, and follow its curve.

These ropes wind on cast iron rollers, which are placed on a horizontal shaft at the base of the opening.

The rollers are 10 inches in diameter and 14 inches long, and have spiral grooves in which the ropes wind cut on their surfaces.

Four turns of the rope are wound on each roller to prevent slipping. Two bucket boxes carry the shaft on which the rollers are fixed. One end of this shaft has a screw thread whose pitch corresponds to that of the rollers, and the box for this end serves the double purpose of support and nut. The other support has a bevel wheel with a long hub fixed to it, the outside of this hub forms the journal bearing, and by means of a feather key and long keyway in the shaft, motion is imparted to the bevel wheel. The shaft and rollers travel sidewise, thus causing the ropes to unwind in a continuous plane, and motion is communicated to the whole device by means of the ordinary groove wheel and rope. 4 collars are fastened to each rope at suitable distances, and when the upper shutter has been opened, two of these collars are released and pass on over the rolls, the next set of collars drawing up the lower shutter in its order.

Some trouble was experienced after the ropes were in use for a time, owing to stretching. This was overcome by a very simple and ingenious device, which takes all the slack as the rope moves in either direction. It is shown in the plate near the rolls. This invention was by Mr. F. D. WINKLEY, at that time a student in the University. It consists of two triangles with two rollers on each; the rope passes alternately under and over these rollers. The ends of the angles are connected, and any pressure from the descending part of the rope, causing slack on the ascending portion, is instantly taken up by the other angle and rolls."

OBSERVING CHAIR.

An observing chair was constructed by Professor WATSON, on essentially the same plan as the large chair of the Harvard College Observatory. In fact the drawings of the present chair were made from the published account of the Cambridge chair, by Mr. F. D. WINKLEY, and the patterns for the castings, iron work, etc., were all made by him, under the supervision of Prof. WATSON and Mr. C. I. KING, Superintendent of the University Machine shops. An important improvement was introduced which permitted the observing seat to move quickly up and down.

The object end of the equatorial will not swing free of it, how-

ever, in many positions of the telescope, which is a source of serious danger in fact, and of constant anxiety to an observer who is called upon to manœuvre his telescope in the dark. It has therefore been dismounted for the time.

The present observing chair is made from the designs of Prof. G. W. HOUGH, Director of the Dearborn Observatory, as given in the *Monthly Notices of the Royal Astronomical Society*, vol. 41, p. 310 (1881.) I refer to the figure given there and to the plate of the large dome in this volume.

The step ladder is 11 feet high and 5 feet wide. Upon it are screwed two strips, S S, between which the chair-frame, A C, slides. The seat C, is 24 by 12 inches. To the top step of the ladder one end of a rope, A, is attached firmly; the other end is passed *once* round a fixed pulley, A, 5 inches in diameter, and from thence passes over a fixed pulley B, to change direction. From B the rope goes to the top of the steps over a fixed pulley and down to a weight W, which can move vertically between guides.

W is so weighted as to keep the chair from moving *down* when the observer is seated, and is not enough to cause the chair to move *up* when it is empty. A slight push, however will raise the chair when it is not occupied, and after the observer is seated a slight pull on the rope I will allow of a descent. By this simple means the observer can place himself precisely where he wishes to be, and after a trial of six months this chair has been found to be perfectly suitable for its purposes, and much superior, in all respects, to any form of observing seat I have ever seen. The frame of the chair is of light ash, the hand-rail and steps are of pine and the whole is mounted on 4-inch castors. The steps are carpeted, to prevent eyepieces, etc., laid on them from falling off, and to absorb dust.

ELEVATOR OR HYDRAULIC LIFT.

"For the purpose of reading the declination circle Prof. WATSON devised and had made an elevator, which consisted essentially in a step ladder leading to a platform two and one-half feet square, both being enclosed in a heavy frame moving on four wheels. The step ladder had seven steps; the platform is six feet above

the floor. The frame under the platform carries a hydraulic lift, which is intended to be worked by an assistant. By means of this lift the platform, with an observer upon it, can be raised from its usual place to ten feet above the floor. The observer cannot raise himself, but by turning a handle he can descend, and can arrest his descent at any desired point.

The weight of the lift was about 500 pounds. The stand moved on castors with rubber tires. The castors were arranged to be moved all at once by the single movement of a hand lever.

This device is shown in plan and section on Figs. 1 and 2.[1] A cast right angle with a web at the bottom which filled the space from one extremity of the angle to the other, was fitted to each inner corner of the frame. This web supported a hub, a, Fig. 2, which formed the socket for the castor post, and also received a collar b, on its upper end.

This collar had a portion of its outer surface cut away, leaving two inclined planes at the ends of the depression, as shown by the dotted lines at a, Fig. 1. Immediately on top of this collar was a ratchet disc c c, which was fastened to the castor post; it also carried the arms d, d, which move independently of the castor when the catch f is displaced.

Two springs, e, e, Figs. 1 and 2, are placed on the under face of the collar. In operation, when the arms are moved, the castors turn until the projection on the catch passes up the inclined plane a, Fig. 1; the arm is then released and the spring preventing the catch from falling back in the same notch of the ratchet, allows it to be drawn back to the next. Thus it will be seen that the castors could be turned in either direction, and by placing the four wheels with their axes directed to the centre, the whole stand could be turned as on a common centre. The arms d, d, were all connected by light steel rods, and all moved at once."

Many of the ingenious devices of this machine are due to Messrs. C. I. King and F. D. Winkley.

It will be observed that the necessity for this cumbrous, although ingenious device, would have been obviated if the

[1] The drawing of this device was received too late to have a wood cut made of it.

makers of the equatorial had set the declination circle close to the telescope instead of at the middle of the declination axis, and had read it by means of microscopes, as at Washington. They have previously constructed mountings containing this improvement.

As the observations now in progress at the observatory do not require the frequent reading of the fine circle in declination (for which end this lift was designed), it has been temporarily dismounted.

THE EQUATORIAL TELESCOPE AND PIER.

The telescope was made by ALVAN CLARK & Sons in 1878, and was mounted by them in January, 1879.

The *objective* has a clear aperture of 15.56 inches, and a focal length of 243± inches. It is composed of two lenses separated about 1.78 inches. The cell is provided with three ventilators which open nearly the whole space between the glasses. It is presumed that, in this way, the whole objective can be quickly brought to the temperature of the surrounding air, and thus to its best performance. No use has been made of this device up to this time.

The *tube* is of rolled steel about $\frac{1}{16}$ inch thick at the ends. The centre section is thicker and is fastened to the declination axis. The polar axis is counterpoised by a stiff spring so as to take the weight of the telescope off the bearings. The declination axis has no counterpoises.

The *hour circle* is 19.8 inches in diameter, divided to 1^m and reads to 1^s by two verniers. The numbering is consecutive from 0 to 24 hours. The outer rim of the hour circle is painted white and divided to 5 minutes of time by black lines. This graduation is numbered consecutively from 0^h to 24^h, by printed figures about half an inch high. These are cut apart, pasted to the circle by a glue composed of gutta percha dissolved in carbon bisulphide, and the whole covered with three coats of transparent shellac.

The *declination circle* is 27.9 inches in diameter, divided to 15′ and read by two verniers to 15″; a most inconvenient fashion. It is also divided to single degrees on the outer rim, which read polar distance from 0° to 360° consecutively. A supplementary numbering on the outside gives declination directly.

The *Driving Clock* is of the BOND Spring-Governor pattern and performs in an entirely satisfactory manner.

Of the excellence of the telescope, the work done must speak. Satisfactory measures have been made by Mr. BURNHAM of such stars as

β *Scorpii;* distance=0″.9; magnitudes 2 and 10.
ν *Scorpii;* distance=0″.9; magnitudes 4 and 6.5.
2 *Serpentis;* distance=0″.4; magnitudes 6 and 7.8.
O. Σ. 298; distance=0″.4; magnitudes 7.8 and 7.9.
Σ 2173; distance=0″.3; magnitudes 6.3 and 6.4.
99 *Herculis;* distance=0″.5; magnitudes 6.0 and 9.5.
85 *Pegasi;* distance=0″.6; magnitudes 6 and 11.
32 *Herculis;* distance=3″.3; magnitudes 6.3 and 13.5.

etc., etc., and very faint nebulæ have been discovered with it, and no nebula which has been looked for has it failed to show.

The eye end of the telescope is finished in brass, and into this eye end the micrometer or the adapter, which carries the plain eye pieces, can be screwed. The lithographed view of the Telescope and Dome gives a good general idea of the proportions of the telescope. It will be noticed that the declination axis is much nearer the eye than the object end of the tube. The distances are about 95 and 130 inches respectively. It was this relation which interfered with the use of the original observing chair.

MICROMETER.

The following account of the changes which have been made in the micrometer has been written by Mr. BURNHAM, to whom these improvements are due.

It is essentially the account published in the *English Mechanic* of September 16, 1881, and the cut has been kindly furnished by the editor of that journal. These cuts were made from photographs of the first device, and differ but slightly from the more elegant mechanical arrangements which have been lately fitted to the micrometer by Mr. GEORGE CLARK, to whom my especial thanks are due.

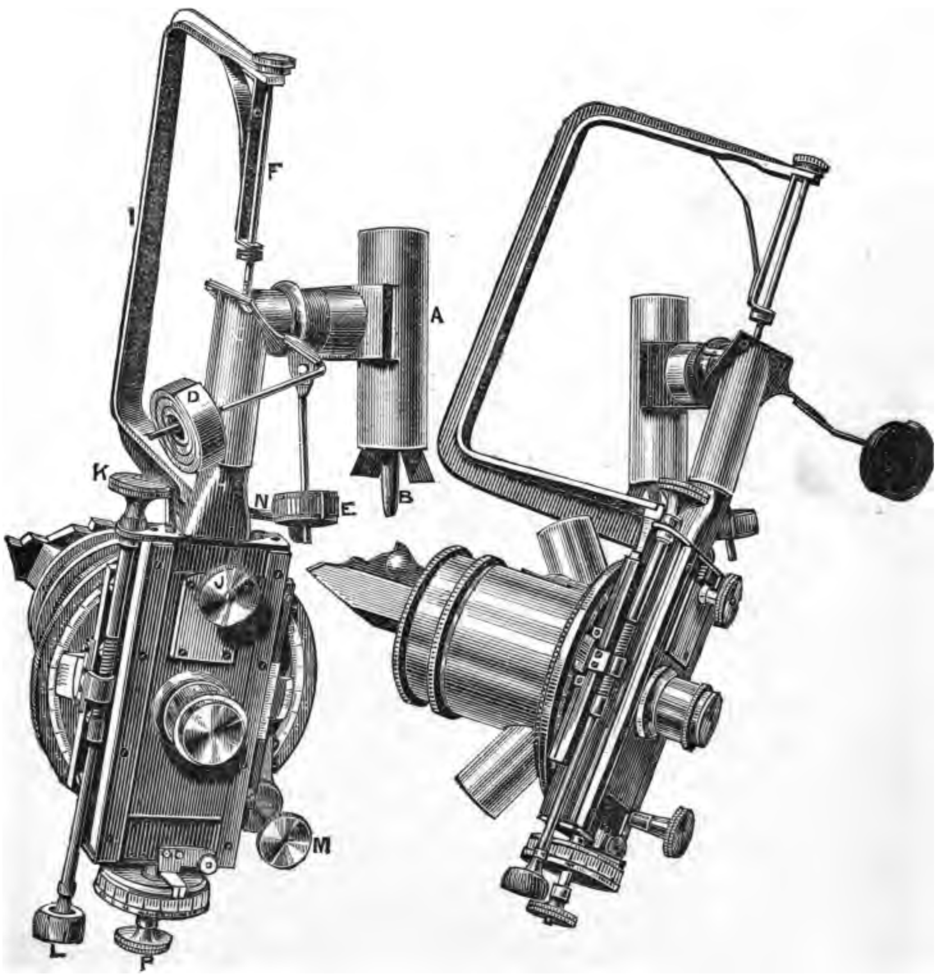
"The micrometer attached to the 15½ inch equatorial of the Washburn Observatory was furnished by the makers of the telescope, ALVAN CLARK & SONS.

"A good many changes have been made in the micrometer, and a new method of illuminating the wires devised, which in practice has been found very satisfactory. It has been fully tested by making several hundred double-star measures, and such changes and further improvements made as were deemed desirable.

"The double stars regularly measured are of the class requiring the most perfect illumination of the wires possible, being for the most part very close pairs or very faint companions and unequal pairs. In many cases it would be simply impossible to use a bright field and get satisfactory results. My experience is that the bright wire illumination is practically much the best for all purposes, and beyond all doubt the best for the most important double star work. All my attempts to use a bright field have been wholly disappointing. The great trouble heretofore in using bright wires has been to avoid stray light in the field from the micrometer lamp and to get sharp and uniformly bright wires in the varying positions they must take. In the FRAUNHOFER diagonal-arm plan generally used, it is necessary to rotate the lamp with every change of the wires in position angle, so as to bring the lamp into the plane which passes through the micrometer-screw and the axis of the telescope — otherwise the light is feeble, and the wires, when brought within two or three diameters of the webs, are indistinct and hazy. Again, a shadow is cast on the wire, or the light is more or less reduced when the lamp is placed in the proper position with reference to the wires, by the partitions between the holes in the tube of the telescope through which the light passes from the hollow arms. Many other devices have been suggested and used; but it is questionable if any plan has been thoroughly tested in practice, which is better than the one last referred to, notwithstanding its many defects. Indeed, nothing is easier than the attaching of a lamp to a micrometer in such a way as to readily *show* the wires. In the course of attempts to improve the illumination of one micrometer in particular, on my 6 inch equatorial, which had all the defects of all micrometers and none of their excellencies, various results were obtained, which, so far as one could see, promised to be successful; but when the micrometer was attached to the telescope, and moder-

ately close and unequal double stars sought to be measured, the light was found to be an utter failure for any such work. It is hardly necessary to say that almost any plan will answer fairly for measuring wide and bright stars; but the time has gone by when it is worth while giving a fine telescope to such work any considerable part of the time.

"The accompanying engravings, from photographs of the micrometer and the lamp attachment, will make plain the end-illuminating plan used at this observatory. The square micrometer box in front of the position-circle is exactly 6 inches in length, and from this the dimensions of the various parts will be easily seen. A is the lamp, moving freely around the horizontal end of the tube C, and kept in a vertical position by the weight E. The light from the lamp passes into C, and after a reflection from a mirror in the angle of C, passes through H into the micrometer box, and directly on the wires, a small lens being placed in H. The rod F is screwed firmly into C, and forms an axis about which the latter turns freely. The counterpoise D, attached to C by a bent arm, keeps the shorter arm of C, to which the lamp is attached, always horizontal. The long arm I is sufficiently bent or curved to allow the lamp to swing through it in any position. I is attached by a set screw, N, to the plate in which the micrometer-box slides when the bisecting screw K is turned, so that the additional weight of the illuminating apparatus has no connection with the bisecting and micrometer screws. The tube C fits closely over H, forming a support or bearing when the longer arm of C is in a horizontal or inclined position. H passes inside C perhaps half an inch in the normal position of the box. This distance is increased or diminished as the bisecting screw K L is turned. The outside of the lamp A is made of tin, open at the bottom and top. The lamp itself, somewhat smaller than the inside diameter of A, so as to give a free draught, is inserted from the bottom, and held in place by thin brass springs attached to the lamp, and pressing against the inside of A. Gas has also been used in place of the lamp, a small flexible rubber tube being attached to B, and running up the telescope tube over the intersection of the axes, and thence down the pier



F
I
A
D
K
N
E
B
J
M
L
P

to the floor. This rubber tube is always in place, not being disturbed by reversing or moving the telescope in any position, and gas is sometimes more convenient than an oil-lamp, which requires more or less attention. It will be readily seen that the micrometer lamp will always maintain a vertical position, no matter what the position angle of the wires may be, or the place of the eye-end of the telescope. The light from the lamp is coloured or diminished at pleasure by means of a glass which moves in the slot in A, as shown. The edge of the lower part of the arm I, for convenience in counterpoising, fits into a slot in one of the diagonal hollow arms, and turns the latter with it. To the opposite hollow arm a weight is attached (not shown in the engraving) sufficient to balance the micrometer lamp and its attachments. The lamp tubes, arm, etc., should be made as light as possible; but I should be rigid enough to have no appreciable flexure in the different positions.

"Other changes have been made in some of the working parts of the micrometer, which have been shown by experience to be of importance. The bisecting screw K has been extended on the side opposite the nut and fitted with an additional head, L The pinion for rotating the micrometer-box has been changed to a point opposite K, and is moved by the milled head M. It is hardly necessary to say that, in measuring angles, either K and M or L and M must be used simultaneously, one with each hand. If the micrometer-screw is anywhere near a horizontal position, K will naturally be used with the left hand, and M with the right. If the micrometer screw is more nearly vertical, L and M will be used. In the same way, in measuring distances, K and P, or L and P will be used at the same time — the former when the box is horizontal, and the latter when it is more nearly vertical with respect to the observer. There is no position where it is not entirely convenient to use one or the other in all measurements — an important advantage, not found, so far as I know, in any other micrometer.

"The pinion M is in exactly the right place, and could not be so conveniently used in any other. Some of the points to which attention has been called here may seem of very little consequence; but any one who makes it a practice to measure twenty

or thirty stars every clear night will soon find that they bear an important relation to the results obtained. As it now stands, I think the micrometer described possesses many advantages not found in any other intrument. With such an instrument, anything can be measured which can be seen at all, by averted vision or otherwise."

EYE-PIECES.

The regular zone eye-piece has a magnifying power of 145 diameters, and a field of view of 25′.5. It was made by E. KAHLER, of Washington, and will show double stars divided down to 1″. It is of the Kellner construction.

The *Finder* has a field of 1° 20′ and a power of 26. A dew cap, 2 feet long, has been fitted to it.

The following eye-pieces were furnished with the micrometer, by the CLARKS:

I. 195 diameters; field=11′.6.
II. 260 diameters; field= 8′.6.
III. 430 diameters; field= 5′.6.
IV. 750 diameters; field= 3′.6.

Besides these a set of STEINHEIL achromatics is now making by KAHLER. A number of periscopic and negative eye-pieces are on hand, but no regular use has been made of them.

A polarizing eye-piece for observations of the sun was also furnished by the Messrs. CLARK.

The following memorandum of measures about the Equatorial is printed for convenience. Reference should be made to the plate of the telescope and dome.

Clear aperture of Objective 15.56in.; focal length 243in. ±.

Clear aperture of Finder 3.5in.; focal length 58in. ±.

Field of view of Finder eye-piece 1° 20′; magnifying power 26.

Pier above floor of dome.

The total height of the pier above the floor of the dome is 7 feet 7 inches, as follows:

Part covered by base board..	1 ft. 0¾ in.
Masonry, brick...........	4 ft. 10½ in.
Stone cap...........	1 ft. 7¾ in.
Dimensions of base board at floor.	3 ft. 2½ in. by 4 ft. 6¾ in.
Dimensions of pier at top....................	1 ft. 7¾ in. by 4 ft. 1¾ in.

Telescope Tube.

From outer face of object glass cell to the clamp flange on the declination axis	10 ft.	4.27 in.
Diameter of clamp flange	0 ft.	10.98 in.
Clamp flange to end of large part of tube	7 ft.	5.72 in.
First small section of telescope tube	0 ft.	3.94 in.
Second smaller section of telescope tube	0 ft.	7.2 in.
Middle section of large part of telescope tube	4 ft.	11 in.
Eye end section of large part of telescope tube	5 ft.	6 in.
Objective end section of large part of telescope tube	8 ft.	4 in.

	Measured circumference.	*Computed diameter.*
Just below cell of objective	52.8 in.	16.81 in.
Middle section of tube	58.25 in.	18.54 in.
Rim at lower end of lower section	47.0 in.	14.96 in.
Just above rim	44.1 in.	14.04 in.
First small part of tube	19.0 in.	6.05 in.
Second small part of tube	11.4 in.	3.63 in.

Miscellaneous.

Intersection of polar and declination axes above floor of dome, 13 ft. 0 in.

Pitch of adjusting screws in ξ and η, 12 threads to an inch.

Distance from adjusting screws to fixed bearing points, 3 ft. 3¾ in.

One turn of the adjusting screws; $=438''$ in ξ; $=320''$ in η.

Distance from objective to nearest point of shutter gearing, 2 ft. 10½ in.

Separating power of equatorial, 0".29. DAWES.

Magnitude of *minimum visibile* in equatorial, 15.1 mag. ARGELANDER.

Magnitude of *minimum visibile* in finder, 11.0 mag. ARGELANDER.

A force of less than two pounds applied to either end of the telescope will keep it in uniform motion about the polar axis, and half as much suffices to keep it moving about the declination axis.

MERIDIAN CIRCLE.

A meridian circle was ordered by Governor WASHBURN from the REPSOLDS, during his visit to Hamburg in 1881.

Having regard to the limited space afforded by the west room,

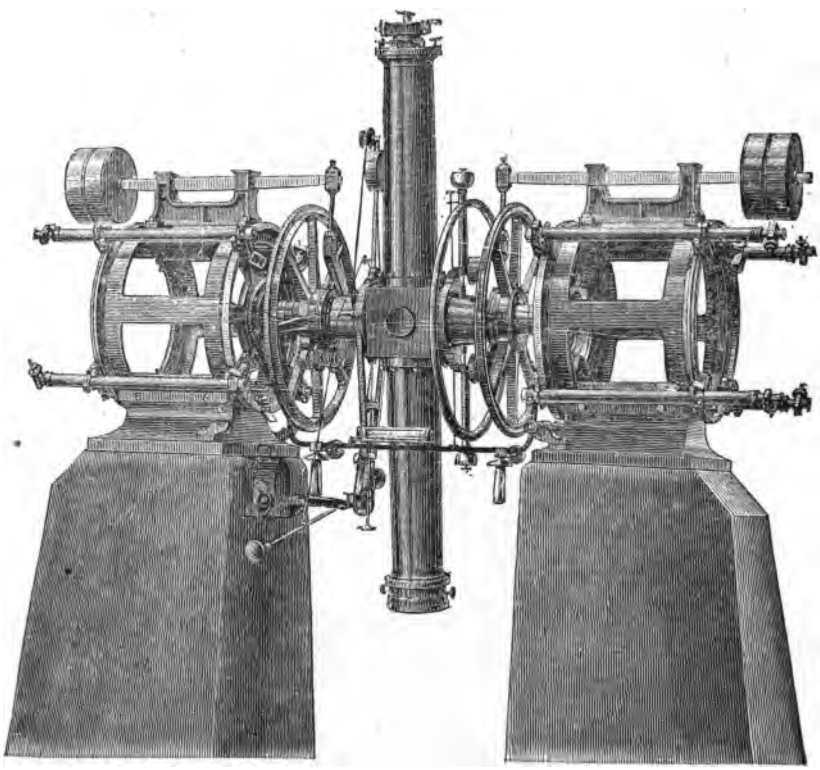
and to the fact that few private observatories have a sufficient force of observers and computers to keep a meridian circle in active operation, it was decided to take one of the smaller circles, such as have been made for the observatories of Tokio, Wilhelmshafen and Williamstown, Massachusetts.

The design is precisely the same as that of the 6-inch circles of the observatories of Bonn, Brussels and Strassburg, but the aperture of the objective is to be 4½ French inches, or 4.8 English inches. The accompanying cut gives a good idea of it.

It was stipulated in the contract that the objective should be made by ALVAN CLARK & SONS, but it is to be mounted in its cell by the Messrs. REPSOLD. The piers are to be of brick, wrapped with felt and encased in wood. On top of the piers rest the cast iron microscope bearers, which carry four large microscopes over each pier. These microscopes are movable. The weight of the instrument is taken off the Ys by counterpoises above the microscope-bearers, and during reversals of the instrument these weights are kept in their usual position by chains attached to the wood casing of the piers, so that the disposition of the weights above the piers is always the same. The instrument has only one circle finely divided to 2′. The other circle is used for setting. The circles are about 22 inches in diameter.

It is intended to have glass reticles for the circle and the collimators, and Professor W. A. ROGERS of Harvard College Observatory has kindly consented to rule these. The small size of the meridian room will force us to use short collimators, about 3 feet in length.

The piers for the instrument and collimators are to be of brick, laid in cement. The piers for the instrument are 59.06 inches high (above the floor); those for the collimators are 66.73 inches. The dimensions of the piers of the instrument, on top, are 19.69 inches square. Eleven inches below the floor they are 33.07 inches square. The collimator piers on top are 31.89 inches (north and south) by 15.75 inches (east and west). Eleven inches below the floor they are 33.86 inches (north and south) by 33.07 inches (east and west). The distance from the centre of the circle piers to the nearest faces of the two collimator piers is 70.87 inches.



This leaves a small space between the wall and the collimator eyepiece of about 17 inches. The foundations laid by Professor WATSON for his six-inch transit piers will be utilized, and the piers for the REPSOLD circle will be built upon them. A sheet of lead will be laid between the foundation and the piers themselves. After the piers are built they will be covered with felting and cased in wood. New foundations for the collimator piers will require to be built, and it is expected that this work will all be finished in the winter of 1881–82.

A more detailed description of this instrument will be given when it is necessary. For the present it may be said that it is entirely adequate, optically, to any uses it is likely to be put to, and mechanically it represents the highest stage of the art of instrument-making.

THE LIBRARY.

The professional books of Professor WATSON were by him bequeathed to the National Academy of Sciences and these books have been generously lent to the Washburn Observatory by the Academy. In addition to these, a valuable collection of star catalogues, star-maps and works on the history of Astronomy have been provided by Governor WASHBURN. The observatory has also to thank the givers of the very numerous and valuable presents of books which it has received, and its especial thanks are due to Dr. OTTO VON STRUVE for a complete set of the Pulkova Observations, to the Royal Astronomical Society, the Royal Observatory at Greenwich, the U. S. Naval Observatory, the Smithsonian Institution, and many others for series more or less complete.

The Library now contains some 700 books and about 1000 astronomical pamphlets.

METEOROLOGICAL INSTRUMENTS.

A United States Signal Service wind-vane has been placed on the Dome of the Student's Observatory. The observatory also has a standard barometer made by GREEN, of New York, No. 5162, a standard FAHRENHEIT thermometer, by GREEN, No. 5164, a standard centigrade thermometer, by GREEN, No. 5163, and an aneroid barometer, by CASELLA, No. 4114.

The instruments made by GREEN have been kindly tested for me by Dr. L. WALDO, in charge of the Thermometric Bureau of the Winchester Observatory, who has sent me the following memoranda of corrections required at the date of testing, Nov. 5, 1881:

Thermometer No. 5162.

32° F	Correction	0°0 F.
52° F	Correction	0°0
72° F	Correction	0°0
92° F	Correction	— 0°1

Thermometer No. 5163.

0° C.	Correction	0°0 C.
11° C.	Correction	0°0
22° C.	Correction	— 0°1
33° C.	Correction	— 0°3

Thermometer No. 5164.

32° F	Correction	0°0 F.
52° F	Correction	0°0
72° F	Correction	0°0
92° F	Correction	— 0°1

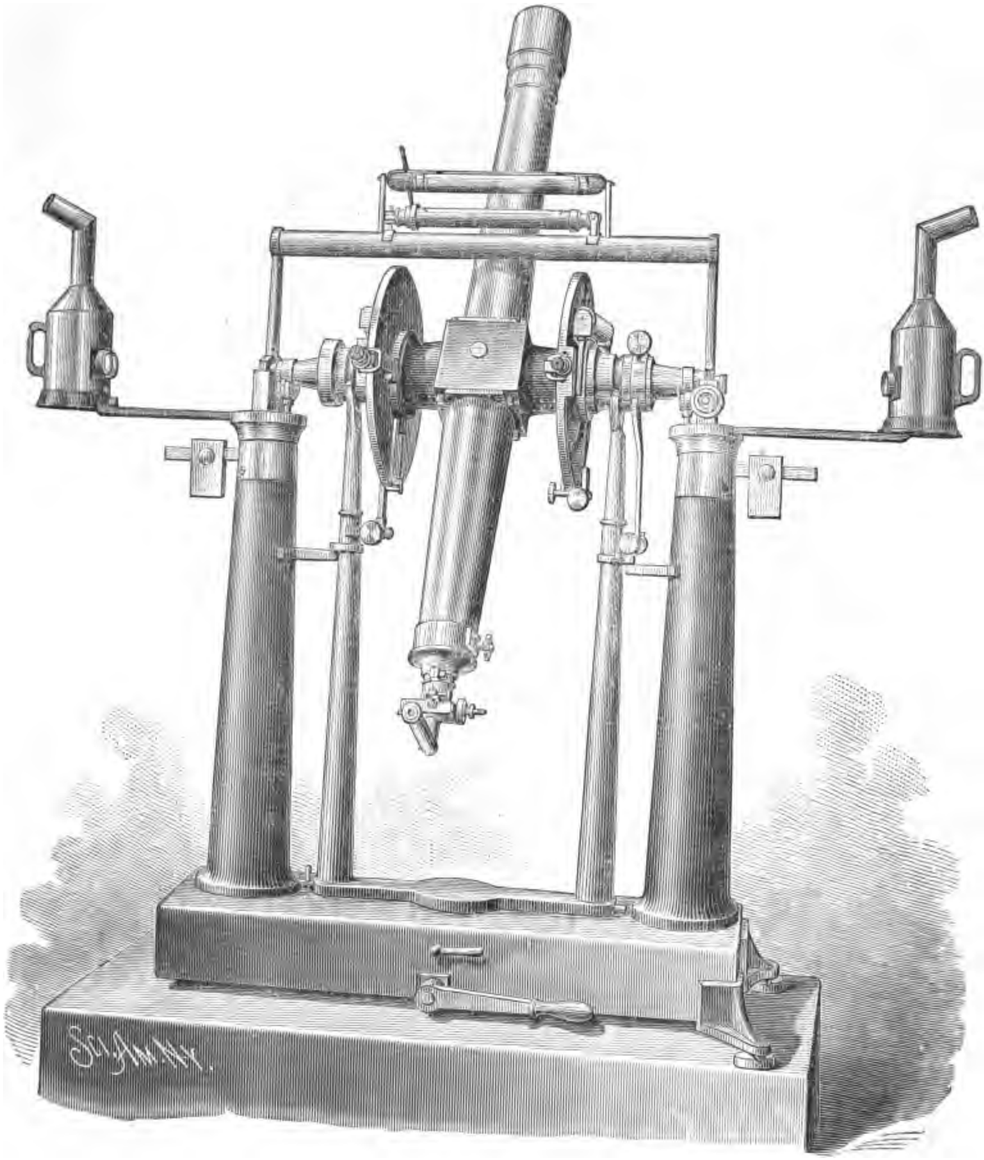
The Cistern of the Barometer is, as before stated, 961 feet above sea level.

HOURS FOR VISITORS.

The Observatory is opened to visitors during the day time whenever any of the Astronomers are in the building, and the evenings of the first and third Wednesdays of each month, when the sky is clear, are also devoted to the reception of visitors during the early hours of the night.

The Senior Class in the University is shown the principal objects of interest on stated evenings during the year, especially during the spring term, when they are engaged in the study of their text book.

The students of the Junior, Sophomore and Freshman years are encouraged to come on the regular visiting nights (two Wednesdays in each month). By this arrangement, a student interested in astronomy has an opportunity of seeing many of the most interesting objects in the heavens before his regular studies in astronomy commence.


Sci.Am.N.Y.

THE STUDENTS' OBSERVATORY.

In order to leave the principal instruments of the Observatory entirely free for scientific work proper, Professor WATSON had begun the construction of a Students' Observatory a few feet northeast of the main building. This building was to be equipped with a transit and an 8-inch equatorial, to be made in the University Machine Shops at Professor WATSON'S private expense.

At the time of his death the building was quite unfinished, but as its purpose is so eminently practical, both as leaving the main Observatory free for scientific work and as providing a place where students may acquire a knowledge of practical astronomy, it was completely finished by Governor WASHBURN, and a 3-inch Transit and Zenith Telescope combined was ordered for it by him from FAUTH & Co., of Washington.

A cut of this instrument is given herewith. For the use of this cut I am indebted to the makers of the instrument.

The base and piers are of iron, the instrument of gun-metal. It is pretty stable, much more so than the ordinary portable transit. It is easily reversed, without materially changing the level correction. Its telescope is large enough to allow of the easy observation of stars of the 7th magnitude, with a bright field. It has two circles, one divided to whole degrees and read with a pointer; the other finely divided and read with a vernier to 10″ of arc. The first is used for setting, the second for latitude observations. The reticle is on glass and has 13 transit wires in groups of 1, 3, 5, 3, 1. The middle wires of each group serve for eye and ear observations, the equatorial intervals being about 9 seconds. Group C of five wires is used for polar stars and for chronographic transits. The equatorial intervals of C are about 1.8 seconds. Table XII gives nearer values of these.

The micrometer can be used either in R. A. or in Z. D., the whole eye end having a motion round the axis between 2 stops 90° apart.

The cut shows the parts of the WASHBURN transit, which differs only in a few unessential points from the representation.

A summary of the constants of this instrument follows.

Diameter of the objective, 3.0 inches.

Focal length of the objective, 37.99 inches.

Power of diagonal eyepiece, 120 ± diameters. This is the eyepiece used in observation.

Power of inverting eyepiece, 60 ± diameters.

The diagonal eyepiece has been fitted with a counterpoise weight, which keeps it in any required position.

Length of azimuth bearing on the base of the stand, 33.02 inches.

The adjusting screws in azimuth have 40 threads to an inch.

One turn of the adjusting screws is $10^s.4$.

Length of the level bearing on the base of the stand, 31.7 inches.

The adjusting screws in level have 30 threads to the inch.

One turn of the adjusting screws is $14^s.5$.

One division of the latitude level is $3''.37$.

Its radius of curvature is 398 feet.

One division of the striding level is $1''.61 = 0^s.107$.

Its radius of curvature is 833 feet.

The micrometer screw has 100 threads to the inch.

One turn of the screw is $54''.29$.

MERIDIAN MARKS.

In the summer of 1881 a series of five meridian marks was painted on the rocks near the shore of Lake MENDOTA some four miles distant. It was hoped that some use could be made of these as a check on our azimuth determinations, and a series of micrometer measures of their positions was begun. It was found, however, that the results of the measures of different days differed very widely while the measures of each day were in close agreement. This was concluded to be due to irregular changes in the horizontal refraction. The approximate azimuths of the marks are (east of north):

Mark:	I;	II;	III;	IV;	V.
Azimuth:	$5^s.0$;	$8^s.3$;	$12^s.3$;	$13^s.3$;	$17^s.9$.

The pier for an equatorial was constructed under the small dome and the 6-inch CLARK equatorial belonging to Mr. S. W. BURNHAM is temporarily mounted on it. It is expected that this instrument will be bought by the University for the use of students, and for use in the Solar Observatory.

This small observatory is a model of what such a one should be in every respect, and owes its special excellence largely to Mr. F. D. WINKLEY, by whom most of the details were designed and executed. I give a brief description of it here with dimensions which may be of use in building similar structures. The building, which is entirely of wood, faces the south and is of one story throughout. A shallow cellar of about 4 feet deep is under the whole floor.

The entrance from the south is into a hall 7.4 feet (north and south) by 6.3 feet (east and west). This hall is lighted by two windows, one north, the other west. From this hall a door to the east enters the dome. The radius of the spherical dome is 6.7 feet. The slit is 18 inches wide. This is too narrow; it should have been at least 2 feet. The dome is supported on an octagon structure, the *inner* sides of the joists forming one side of the octagon, being 4.5 feet. The north west side of the octagon is omitted, and the angle of the walls is there a right angle, to join the walls of the hall. The floor of the dome was originally 8 feet 5 inches below the turning part, but to fit it to receive a six-inch equatorial a second floor has been put in some 2.5 feet higher. The transit room is 12.0 feet (north and south) by 13.9 feet (east and west). The ridge of the roof runs east and west, and there are two slits 16¼ inches wide, one in the prime vertical, the other in the meridian. The eaves of the room are 8 feet 9 inches above the floor. The roof is supported by the walls and by four posts, grouped around the pier. The Transit Room has one window in the north east corner.

PIERS.

Transit Pier: This extends 63.5 inches below the floor, and at its base it is 46 inches square, at the floor line 33 inches. Above the floor it is 28 inches square, by 20 inches high to the base of the cap-stone, which is 33 inches square by 10 inches thick. The whole pier (with the exception of the cap of Joliet stone) is built of white brick laid in cement, and the part above the floor is painted. If it were to be built again, I should make it about 3 inches lower. The weight of a man on the north or south edge

of the cap-stone will move the latitude level $\pm 1''$, but it returns to its place as soon as the weight is removed.

The Equatorial Pier: This is built of selected red brick laid in cement and rubbed down to shape. It is 8 feet 6 inches above the (present) floor, which was laid to accommodate the 6-inch CLARK equatorial, loaned to the Observatory by Mr. BURNHAM, which is now mounted there.

SHUTTERS.

The shutter for the dome is built on the principle that the parts to fit the tracks must be rigid and the other parts flexible. Several pieces of ash cross the shutter, and at their ends have rollers. These are connected by a strip of band iron about $\frac{1}{8}$ of an inch thick, and one inch wide. To this the tin covering is fastened. The shutter is opened and closed by a rope, one end of which is fastened one-third of the way from the upper end of the shutter; the other about 30 inches above the bottom. These ropes pass between two wooden rollers 2.5 inches in diameter, extending quite across the slit, and fixed to the Dome; and each rope serves to lift and to hold back alternately.

The transit shutters are of the ordinary form of trap-door shutters, but are very nicely fitted, and can be opened or closed in a few seconds.

This observatory is lighted by oil lamps. A good idea of the building may be had by referring to the two full page views of the Washburn Observatory, in which its east and south sides are shown.

THE WATSON SOLAR OBSERVATORY.

At the time of his death Prof. WATSON had nearly completed the building for a Solar Observatory. This consisted essentially in a cellar 16×20×20 feet, over which was a substantial one-story stone house. This house is situated at the foot of the ridge on which the Washburn Observatory stands, and some thirty feet below it towards the south. From a point 8 feet above the floor of the cellar a tube of tile drain pipe 12 inches in diameter and 55 feet long is directed towards the north pole. A small pipe, des-

tined by Prof. WATSON for a speaking tube, is laid to the east of the large one and parallel to it. At the top of the hill a pier for the large heliostat which Prof. WATSON was intending to construct at his own expense, is partly built. In March, 1881, the building was quite incomplete. It has been finished by Gov. WASHBURN and fitted for quarters for one of the assistants of the Observatory.

It is hoped to try the interesting experiment for which it was principally designed as soon as practicable. In the meantime the inclined tube, heliostat pier, etc., have been protected from the weather. The lithographed view of the Washburn observatory (page 5) shows the Solar Observatory at the foot of the hill.

II. A CATALOGUE OF 195 STARS FOR 1880.

Reduced by Mr. G. C. COMSTOCK *of the Washburn Observatory from Observations by* Mr. J. M. SCHAEBERLE *of the Detroit Observatory of Ann Arbor.*

"The observations upon which the following catalogue is based were made at Ann Arbor between July 4 and December 31, 1879, by Mr. J. M. SCHAEBERLE, with the meridian circle of the Detroit Observatory.

No complete description of this instrument has ever been published, but in construction and general arrangement it is similar to the meridian circle of the Leyden Observatory described in the *Annalen der Sternwarte in Leyden, Erster Band.* It was constructed by PISTOR AND MARTINS of Berlin, in 1853–4. The objective is of 6.33 inches aperture, and 99.5 inches focal length. The circles are divided to two minutes, and are 36 inches in diameter. A magnifying power of 288 was employed for all the observations of the present series.

During the period in which these observations are included, the break-circuit clock (of BRUENNOW'S form) of the Observatory was not in good working condition, and much trouble was experienced in its use; in consequence of this, not more than one-half of the observations were recorded upon the chronograph, the others being observed by eye and ear. In the case of an eye and ear observation, transits were usually observed over five wires, with the chronograph over thirteen, but in all cases only five wires were used in the reduction.

An investigation of the division errors of the circle of this instrument may be found in Nos. 10, 11 and 12 of BRUENNOW'S *Astronomical Notices,* from which it appears that the probable error of any line is $\pm$ 0″.38, and as four microscopes were always read and their mean used in the reduction, this probable error is reduced to $\pm$ 0″.19. The periodic errors of the graduation, although they appear, from BRUENNOW'S investigation, to be sensible, were not applied in these reductions.

As this meridian circle is not provided with a declination micrometer, all bisections were made by causing the star to pass midway between two horizontal threads seven seconds of arc apart.

The instrumental constants were determined as follows: The

collimation was measured by means of two collimators north and south, and a micrometer moving in right ascension. During the first part of the observations this constant was determined at average intervals of one week, but subsequent to November 15 it was generally determined for every night upon which observations were made. Previous to November 15 the level constant was determined with a spirit level, which was read before and after the observations of each night; on and after November 15, this constant was determined from nadir observations. The flexure of the telescope tube was determined from the readings of the circle when the telescope tube was pointed upon the collimators, and the flexure thus obtained in the horizon was assumed to vary as the sine of the zenith distance. The clock correction, the equatorial point of the circle, and the value of the quantity "n" were determined from observations of known stars. On each night the barometer and the internal and external thermometers were read at the beginning and end of the night's work, and if the series of observations was unusually prolonged they were read at some time about the middle of the series. The position of the instrument during this series of observations was circle E.

The reduction of these observations was made at the Washburn Observatory under the direction of Prof. J. C. WATSON by Mr. G. C. COMSTOCK, assisted by Mr. E. W. DAVIS, who duplicated a part of the computations.

Throughout the entire work the instrumental constants determined on each night were used in the reduction of that night's observations. The refractions employed were computed from BESSEL'S *Refraction Tables* as contained in CHAUVENET'S *Spherical and Practical Astronomy*. The places of the zero stars used in the reduction were taken from the *American Ephemeris* and the *Berlin List of* 539 *Stars*, the former being preferred when the star was contained in both.[1] The reductions from the observed place to

[1] The Washington Observations for 1867 contains a paper, by Prof. SIMON NEWCOMB, on the *Positions of Fundamental Stars*, etc., from which it appears, p 19, that the star places of the American Ephemeris may be reduced to the system contained in this paper, by applying the systematic correction $+0^{s}.039 \sin (\alpha - 15^{h})$.

In the Washington Observations for 1870, Appendix III, *On the Right Ascensions of the Equatorial Fundamental Stars*, NEWCOMB gives, p. 45, as the

the mean place for 1879.0 were computed from the quantities f, g, G, h, H, and i contained in the *American Ephemeris*. The precession from 1879.0 to 1880.0 was taken in most cases from the "*Catalogue of Stars for Observations of Latitude*," *Appendix No.* 7 *to the Report of the Superintendent of the United States Coast Survey for* 1876, the epoch of which is 1880.0. For such stars as were not found in that catalogue or which were too near the pole to allow the precession for 1880.0 to be substituted in place of that for 1879.5 without introducing sensible error, the precessions were computed directly from the formulæ:

$$\text{Prec. in R. A.} = m + n \tan \delta \sin \alpha,$$
$$\text{Prec. in Dec.} = n \cos \alpha.$$

In combining the results derived for the place of a star from observations made on different nights, the arithmetical mean of the separate results was usually taken, but in a few cases where an observation contained intrinsic evidence of being less trustworthy than the others, it was given diminished weight, but in no case was this diminished weight assigned to a result on account of a deviation from the mean of other determinations.

An approximate value of the probable accidental error of a single determination of a star's place in each co-ordinate has been obtained by comparing each result with the mean of all the results obtained for the same star, in those cases in which a star has been observed on three or more nights. This gives as the probable error in right-ascension and declination respectively.

$$\pm 0^s 040 \sec \delta, \qquad \pm 0''55."$$

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reduction of his first system to his second, $\Delta = -0^s.024$. hence, American Ephemeris$= N^2 - 0^s.024 - 0^s.039 \sin (\alpha - 15h.)$

The Right Ascensions of the *Berlin List of* 539 *Stars* are substantially those of the Pulkova system of 1845. See V. J. S., IV Jahrgang, 4 Heft, 1869. The reduction of this system to Newcomb's system of 1870, as given upon p. 45 of Washington Observations for 1870, Appendix III, is:

$N^2 =$ Pulkova $(1845) + 0^s.019$.

The relation existing between the right ascensions of the American Ephemeris and those of the Berlin List of 539 Stars for 1879 is:

American Ephemeris $=$ Berlin $- 0^s.005 - 0^s.039 \sin (\alpha - 15h)$, and within the limits imposed by this equation the right ascensions of the two systems may be considered comparable.

It does not appear practicable to obtain any simple expression for the corresponding relation in declination.

TABLE GIVING THE SEPARATE RESULTS OF THE OBSERVATIONS OF EACH STAR, WITH THE ADOPTED MEAN PLACES FOR 1879.0.

NOTE.—Those Observations marked with an asterisk are half weight.

No.	Date of Observation.	Observed Appt. R. A.	Reduction to 1879.0.	Observed Appt. Dec.	Reduction to 1879.0.	Mean R. A. 1879.0	Mean Dec. 1879.0	Adopted Mean R. A. 1879.0.	Adopted Mean Dec. 1879.0.
	1879.	h m s	s	° ′ ″	″	s	″	h m s	° ′ ″
1	Oct. 10..........	0 8 44.82	—4.535	21 37 13.19	—30.97	40.29	42.22	....	....
	Oct. 11..........	....	—4.536	13 64	—31.09	....	42.55	....	....
	Oct. 15..........	44.73	—4.536	14 39	—31.57	40.19	42.82	0 8 40.31	21 36 42 28
	Oct. 20..........	44 97	—4.530	13.92	—32.12	40.44	41.80	....	....
	Oct. 25..........	44.85	—4.516	14.62	—32.61	40.33	42.01	....	....
2	Oct. 11..........	0 14 30.63	—4.654	32 14 54.92	—31.23	25.98	23.69	....	....
	Oct. 15..........	....	—4.656	56 33	—31.95	....	24.38	....	....
	Oct. 20..........	....	—4.652	56.90	—32.78	....	24.12	0 14 26.00	32 14 23.97
	Oct. 25..........	30.65	—4.637	57.24	—33.57	26.01	23.67	....	....
	Nov. 1..........	30.63	—4.606	58.53	—34.55	26.02	23.98	....	....
3	Oct. 20..........	0 23	—5.537	59 18 62.80	—32.57	....	30.23	....	....
	Oct. 25..........	41.00	—5.504	64 39	—34.01	35.50	30.38	0 23 35.36	59 18 30.72
	Nov. 1..........	40.59	—5.437	65.23	—35.89	35.15	30.08	....	....
	Nov. 12..........	40.71	—5.281	70.71	—38.53	35.43	32.18	....	....
4	Oct. 15..........	0 23 56.46	—4.562	—4 36 66.19	—29.11	51.90	35.30	0 23 51.90	—4 37 35.30
5	Oct.* 20..........	0 29	—4.652	23 22 1.83	—31.80	....	30 03	....	....
	Oct. 25..........	52.08	—4.650	3.33	—32.35	47.43	30.98	0 29 47.49	23 21 30.50
	Nov. 4..........	52.18	—4.623	....	—33.26	47.56	....	....	....
6	Nov. 4..........	0 30 49.81	—4.630	23 21 30.24	—33.24	45.18	57.00	....	....
	Nov. 15..........	....	—4.573	31.94	—33.97	....	57.97	0 30 45.18	23 20 57.48

7	Nov. 15	0	47	6.67	—4.712	26	33		—34.06	1.96	8.16	0	47	1.96	26	33	
8	Oct. 25	0	49	32.91	—4.698	26	33	42.22	—31.93	28.21	10.29						
	Nov. 4			32.95	—4.789			43.73	—33.03	28.16	10.70						
	Nov. 12			32.82	—4.765			44.27	—33.75	28.06	10.52	0	49	28.14	26	33	10.81
	Nov. 15			32.98	—4.730			45.71	—33.97	28.15	11.74						
9	Nov. 6	0	49	58.78	—6.451	65	42	26.67	—35.46	52.83	51.21						
	Nov. 25							30.18	—40.19		49.99	0	49	52.33	65	41	50.60
10	Nov. 4	0	56	16.33	—4.909	31	9	48.39	—33.21	11.42	15.18						
	Nov. 15			16.53	—4.854			49.77	—34.44	11.68	15.33	0	56	11.55	31	9	15.25
11	Nov. 12	0	56	57.79	—6.040	60	56	27.98	—36.60	51.75	51.38	0	56	51.75	60	55	51.38
12	Nov. 6	0	57	1.62	—5.526	51	52		—34.89	56.09		0	56	56.09	51	51	12.98
	Nov. 25						51	51.58	—38.60		12.98						
13	Nov. 4	1	3	50.58	—4.854	24	49	31.45	—32.23	45.73	59.22						
	Nov. 6			50.55	—4.855			31.05	—32.41	45.70	58.64						
	Nov. 12			50.43	—4.844			32.21	—32.89	45.59	59.32	1	3	45.69	24	48	59.05
	Nov. 15			50.53	—4.804			32.74	—33.09	45.73	59.65						
	Nov. 25							32.03	—33.63		58.40						
14	Nov. 13	1	20	30.06	—5.328	40	28	50.35	—33.91	24.73	26.44						
	Nov. 15			30.05	—5.325			51.86	—34.23	24.73	27.63	1	20	24.74	40	28	27.25
	Nov. 18			30.06	—5.312			52.30	—34.66	24.75	27.67						
15	Nov. 4	1	22	32.50	—7.111	65	28	53.12	—32.24	25.39	20.88						
	Nov. 12			33.17	—7.062		28	55.16	—34.50	26.11	20.66	1	22	25.75	65	28	20.77
16	Nov. 6	1	22			65	27	24.66	—32.84		51.82	1	22		65	26	51.82
17	Nov. 4	1	34	38.61	—5.038	25	8	33.35	—30.61	33.57	2.74						
	Nov. 15			38.59	—5.053			34.12	—31.52	33.54	0.58	1	34	33.58	25	8	1.85
	Nov. 18			38.69	—5.049			34.37	—31.72	33.64	2.65						
	Nov. 25							33.56	—32.13		1.43						

TABLE GIVING THE SEPARATE RESULTS OF THE OBSERVATIONS OF EACH STAR, ETC. — continued.

No.	Date of Observation.	Observed Appt. R. A.	Reduction to 1879.0.	Observed Appt. Dec.	Reduction to 1879.0.	Mean R. A. 1879.0.	Mean Dec. 1879.0.	Adopted Mean R. A. 1879.0.	Adopted Mean Dec. 1879.0.
	1879.	h m s	s	° ′ ″	″	s	″	h m s	° ′ ″
18	Nov. 13	2 12 13.25	—5 201	22 36 59.17	—28.53	8.05	30.64	...	...
	Nov. 15	13.24	—5.232	59.59	—28.34	8.01	31.25	2 12 8.03	22 36 31.01
	Nov. 25	...	...	60.08	—28.93	...	31.15	...	...
19	Nov. 12	2 12 25.24	—6.738	55 16 34.63	—29.55	18.50	5.08	2 12 18.50	55 16 5.08
20	Nov. 6	2 14 2.55	—6.723	55 18	—27.86	55.83	...	...	...
	Nov. 18	2 14 2.37	—6.880	55 17 57.70	—30.80	55.49	26.90	2 13 55.66	55 17 26.90
21	Nov. 12	2 22	—5.255	22 56 8.11	—27.70	...	40.41	...	...
	Nov. 13	25.13	—5.260	8 49	—27.75	19.87	40.74	...	...
	Nov. 15	25.11	—5.271	8.82	—27.85	19.84	40.97	2 22 19.86	22 55 40.57
	Nov. 18	25.16	—5.284	8.38	—28.04	19.88	40.34	...	...
	Nov. 25	...	...	8.78	—28.37	...	40.41	...	...
22	Nov. 12	2 43 42.33	—6.354	46 20 55.01	—26.05	35.98	28.96	...	...
	Nov. 13	42.30	—6.362	54.06	—26 25	35 94	27.81	...	...
	Nov. 15	42.26	—6.379	55.57	—26.64	35.88	28.93	2 43 35.90	46 20 28.73
	Nov. 18	42.19	—6.403	56.57	—27.21	35.79	29.36	...	...
	Nov. 25	...	...	57.07	—28.48	...	28.59	...	...
23	Nov. 25	2 46	...	61 2 0.18	—28.65	...	31.53	2 46	61 1 31.44
	Dec. 10	...	—7.883	3.47	—32.12	...	31 35	...	...
24	Nov. 18	2 57 20.58	—8.482	63 35 35.58	—25.30	12.10	10.28	2 57 12.10	63 35 10.28

25	Dec. 27	2	57	60.48	—11.145	73	56	25.96	—35.27	49.34	50.69	2	57	49.34	73	55	50.69
26	Nov. 18	3	6		—7.553	56	41	42.32	—24.21		18.11						
	Dec. 10			39.91	—7.640				—29.10	32.27		3	6	32.20	56	41	16.95
	Dec. 27			39.63	—7.504			47.90	—32.10	32.13	15.80						
27	Dec. 22	3	17	1.74	—6.021	33	6	46.57	—25.98	55.72	20.59	3	16	55.79	33	6	20.34
	Dec. 27			1.87	—5.999			46.34	—26.24	55.87	20.10						
28	Dec. 31	3	17		—5.280	12	12	17.04	—20.92		56.12	3	17		12	11	56.12
29	Dec. 10	3	20	51.01	—6.106	34	10	38.45	—24.82	44.90	13.63	3	20	44.90	34	10	13.63
30	Dec. 22	3	24	7.68 8.46	—6.134	27	9	51.27	—23.94	1.55 2.33	27.33	3	24	1.55 2.33	27	9	27.33*
31	Dec. 31	3	24		—7.505	54	34	14.04	—29.98		44.06	3	24		54	33	44.06
32	Dec. 10	3	25	4.16	—6.178	35	3	20.01	—24.42	57.98	55.59	3	24	57.98	35	2	55.59
33	Dec. 10	3	32	4.40	—5.631	20	31	31.52	—21.68	58.77	9.84						
	Dec. 22			4.22	—5.642			31.98	—21.69	58.58	10.29	3	31	58.67	20	31	10.18
	Dec. 27				—5.632			33.08	—21.66		10.42						
34	Dec. 10	3	36	51.18	—11.142	70	30	1.83	—25.37	40.04	36.46						
	Dec. 22			51.14	—11.031			6.41	—28.47	40.11	37.94	3	36	40.06	70	29	37.31
	Dec. 27			50.97	—10.941			7.16	—29.63	40.03	37.53						
35	Dec. 10	3	54	5.93	—10.706	68	20	56.91	—22.55	55.22	34.36						
	Dec. 22			6.15	—10.672			61.06	—25.59	55.48	35.47	3	53	55.35	68	20	34.91
36	Dec. 31	3	57	55.49	—5.218	2	30	2.17	—14.54	50.27	47.63	3	57	50.27	2	29	47.63
37	Dec. 10	3	59	57.39	—8.002	54	30	45.67	—21.10	49.39	24.57	3	59	49.48	54	30	24.81
	Dec. 22			57.62	—8.036			48.45	—23.39	49.58	25.06						
38	Dec. 31	4	3	80.70	—25.118	83	2	64.29	—27.24	55.58	37.05	4	3	55.58	83	2	37.05

* Double.

TABLE GIVING THE SEPARATE RESULTS OF THE OBSERVATIONS OF EACH STAR, ETC.—continued.

No.	Date of Observation.	Observed Appt. R. A.			Reduction to 1879 0	Observed Appt. Dec.			Reduction to 1879.0.	Mean R. A. 1879.0.	Mean Dec. 1879.0.	Adopted Mean R. A. 1879.0.			Adopted Mean Dec. 1879.0.		
	1879.	h	m	s	s	°	′	″	″	s	″	h	m	s	°	′	″
39	Dec. 22...........	4	5	40.73	—5.691	16	58	7.26	—17.18	35.04	50.08	4	5	35.04	16	57	50.08
40	Dec. 31...........	4	13	29.10	—5.781	18	27	20.09	—16.31	23.32	3.78	4	13	23.32	18	27	3.78
41	Dec. 31...........	4	21	19.80	—6.319	30	5	44.39	—17.56	13.48	26.83	4	21	13.48	30	5	26.83
42	Dec. 31...........	4	27	47.74	—5.410	5	18	59.82	—12.00	42.33	47.82	4	27	42.33	5	18	47.82
43	Dec. 31..........	4	31	13.52	—5.943	20	26	38.01	—14.45	7.58	23.56	4	31	7.58	20	26	23.56
44	July 4...........	15	34		....	32	4	48.61	+ 3.10	....	51.71	....	....	....	32	4	51.71
45	July 8..........	15	37	22.51	—2.957	69	40	29 19	— 2.88	19.55	26.31	15	37	19.51	69	40	27.22
	July 13...........		37	22.18	—2.710		40	31.86	— 3.72	19.47	28.14	....	....	....	....	....	....
46	July 8...........	15	55	41.51	—3 036	50	14	36.63	— 1.04	38.47	35.59	15	55	38.47	50	14	35.59
47	July 4...........	16	22	2.00	....	0	54	6.74	+ 8.07	....	14.81	....	....	....	....	....	....
	July 13...........		22	27.63	—3.584		56	6.34	+ 7.16	24.05	13.50	16	22	24.05	0	56?	14.15
48	July 4...........	16	33		....	43	48	22.09	+ 0.35	....	22.44	....	....	....	....	....	....
	July 19...........		33	45.29	—3.009		48	24.98	— 2.98	42.28	22.00	16	33	42.28	43	48	22.22
49	July 13...........	16	39	27.15	—3.210	34	15	46.58	— 0.48	23.94	46.10	....	....	....	....	....	....
	July 16...........		39	26.93	—3.178		15	46.67	— 1.07	23.75	45.60	16	39	23.84	34	15	45.85

50	July 17	16	41		−3.070	43	26	25.08	−2.69		22.39						
	July 19		41	27.14	−3.038		26	25.58	−3.11	24.10	22.47	16	41	24.10	43	26	22.43
51	July 8	16	47	31.53	−3.408	21	10	32.09	+2.42	28.12	34.51						
	July 16		47	31.47	−3.341					28.13		16	47	28.13	21	10	34.51
52	July 4	16	49			21	9	14.03	+3.10		17.13				21	9	17.13
53	July 8	16	55	55.02	−3.409	22	48	39.42	+1.84	51.61	41.26	16	55	51.61	22	48	41.26
54	July 13	16	59	28.68	−3.433	19	46	1.40	+1.24	25.25	2.64						
	July 14		59	28.79	−3.428		46	2.13	+1.06	25.36	3.19	16	59	25.34	19	46	2.98
	July 16		59	28.83	−3.419		46	2.50	+0.60	25.41	3.10						
55	July 17*	17	1	14.25	−3.383	22	14	54.57	+0.01	10.87	54.58						
	July 19		1	14.19	−3.369		14	54.02	−0.35	10.82	53.67	17	1	10.84	22	14	54.12
56	July 4	17	5			40	55	46.89	+0.28		47.17						
	July 14		5	41.31	−3.198		55	46.76	−2.24	38.11	44.52	17	5	38.11	40	55	45.84
57	July 16	17	7	47.45	−3.066	52	33	31.37	−3.88	44.38	27.49	17	7	44.34	52	33	25.64
	July 17*		7	47.30	−3.048		33	27.93	−4.14	44.25	23.79						
58	July 15	17	10	26.68	−3.746	1	20	43.93	+3.74	22.93	47.67						
	July 19		10	26.89	−3.732		20	43.06	+3.31	23.16	46.37	17	10	23.04	1	20	47.02
59	July 8	17	12	46.18	−3.513	17	26	52.04	+1.94	42.67	53.98	17	12	42.64	17	26	54.14
	July 16		12	46.11	−3.489		26	53.81	+0.49	42.62	54.30						
60	July 4	17	15			25	39	41.63	+1.64		43.27						
	July 17		15	17.23	−3.382		39	39.91	−1.15	13.85	38.76	17	15	13.85	25	39	41.02
61	July 14	17	19	9.78	−3.529	16	24	43.37	+0.70	6.25	44.07	17	19	6.25	16	24	45.90
	July 16		19	9.77	−3.522		24	47.39	+0.34	6.25	47.73						
62	July 15	17	19	11.24	−3.102	53	32	12.95	−3.85	8.14	9.10						
	July 19		19	11.42	−3.033		32	12.16	−4.89	8.39	9.27	17	19	8.26	53	32	9.18

TABLE GIVING THE SEPARATE RESULTS OF THE OBSERVATIONS OF EACH STAR, ETC.—continued.

No.	Date of Observation.	Observed Appt. R. A.			Reduction to 1879.0.	Observed Appt. Dec.			Reduction to 1879.0.	Mean R. A. 1879.0.	Mean Dec. 1879.0.	Adopted Mean R. A. 1879.0.			Adopted Mean Dec. 1879.0.		
	1879.	h	m	s	s	°	′	″	″	s	″	h	m	s	°	′	″
63	July 4..........	17	24		....	—0	57	44.26	+4.40	....	39.86	.....	.....	.....	.....	.....	.....
	July 8.		24	13.92	—3.832		57	44.10	+3.95	10.09	40.15	17	24	10.13	—0	57	39.87
	July 20..........		24	13.99	—3.822		57	42.27	+2.68	10.17	39.59	.....	.....	.....	.....	.....	.....
64	Jnly 14..........	17	28	10.93	—3.519	19	20	42.84	+0.09	7.41	42.93	.....	.....	.....	.....	.....	.....
	July 16..........		28	10.86	—3.503	.....	.....	.....	....	7.36	....	.....	.....	.....	.....	.....	.....
	July 25 *		28	11 15	—3.454		20	43.49	—2.17	7.70	41.32	17	28	7.45	19	20	42.18
	July. 30..........		28	10.85	—3.413		20	45.28	—2.98	7.44	42.30	.....	.....	.....	.....	.....	.....
65	July 15..........	17	28	17.80	—3.549	16	24	14.69	—0.01	14.25	14 68	17	28	14.25	16	24	14.68
66	July 19..........	17	32	30.02	—2.921	68	12	47.91	—5.57	27.10	42.34	.....	.....	.....	.....	.....	.....
	July 20..........		32	29.95	—2.891		12	50.84	—5.84	27.06	45.00	17	32	27.08	68	12	43.67
67	July 4..........	17	37		....	14	21	3.06	+1.88	....	4.94	.....	.....	.....	.....	.....	.....
	July 17..........		37	54.80	—3.599		21	2.00	—0.51	51.20	1.49	17	37	51.20	14	21	3.21
68	July 15..........	17	38	38.14	—3.163	51	52	41.34	—3.97	34.98	37.37	.....	.....	.....	.....	.....	.....
	July 20..........		38	38.43	—3.094		52	44.17	—5.33	35.24	38.84	17	38	35.16	51	52	38.10
69	July 8..........	17	38	50.52	—3.607	14	27	47.24	+1.06	46.91	48.30	17	38	46.91	14	27	48.30
70	July 24..........	17	39	29.10	—2.686	72	31	14.58	—7.19	26.41	7.39	.....	.....	.....	.....	.....	.....
	Aug. 1..........		39	28.60	—2.301		31	16.06	—8.75	26.30	7.31	17	39	26.35	72	31	7.35
71	July 30..........	17	41	30.53	—2.344	53	51	18.65	—8.01	27.65	10.64	17	41	27.65	53	51	10.64

72	July 31...........	17	41	51.10	—3.479	17	44	37.54	—3.61	47.62	33.93	17	41	47.62	17	44	33.93
73	July 26...........	17	41		....	38	55	52.48	—5.79	....	46.69	....			38	55	46.69
74	July 25.......	17	42	2.25	—3.565	39	22	13.35	—5.63	58.69	7.72	17	41	58.69	39	22	7.72
75	July 17*..........	17	43	16.77	—3.519	20	36	22.07	—1.64	13.25	20.43	....			....		
	Aug. 4......		43	16.61	—3.398		36	26.94	—4.86	13.21	22.08	17	43	13.22	20	36	21.25
76	July 20...........	17	45	44.91	—3.390	29	21	23.92	—3.48	41.52	20.44	17	45	41.52	29	21	20.44
77	July 19...........	17	46	31.40	—3.846	1	20	7.71	+0.70	27.55	8.41	....			....		
	Aug. 1...........		46	31.42	—3.817		20	9.20	—0.68	27.60	8.52	17	46	27.57	1	20	8.46
78	July 4......	17	47		....	36	8	14.15	—0.09	....	14.06	....			36	8	14.06
79	July 26......	17	47		....	6	7	40.24	—1.06	....	39.18	....			6	7	39.18
80	July 8...........	17	50	49.37	—3.518	22	29	0.73	—0.26	45.85	0.47	....			....		
	July 17*..		50	49.26	—3.510		29	1.48	—2.23	45.75	59.25	17	50	45.82	22	28	59.86
81	July 15...	17	54	32.23	—3.350	36	17	59.56	—3.24	28.88	56.32	....			....		
	July 20...........		54	32.47	—3.330		17	63.02	—4.51	29.14	58.51	17	54	29.01	36	17	57.41
82	July 17*..........	17	56	13.66	—3.381	33	13	11.25	—3.54	10.28	7.71	....			....		
	July 24...........		56	13.53	—3.338		13	13.42	—6.66	10.19	6.76	17	56	10.22	33	13	7.23
83	July 19...........	17	57	13.36	—3.376	33	18	47.47	—4.15	9.98	43.32	....			....		
	July 31...........		57	13.48	—3.275		18	51.35	—6.82	10.20	44.53	17	57	10.09	33	18	43.79
	Aug. 17...........		57		—3.050		18	53.58	—10.05	....	43.53	....			....		
84	July 14.......	18	1	22.90	—3.413	32	13	17.12	—2.87	19.49	14.25	....			....		
	July 17*..		1	22.85	—3.404		13	18.02	—3.63	19.45	14.39	18	1	14.34	32	13	14.58
	July 18*....... ...		1	22.62	—3.398		13	18.41	—3.87	19.22	14.54	....			....		
	July 20...........		1	22.87	—3.390		13	19.50	—4.36	19.48	15.14	....			....		

TABLE GIVING THE SEPARATE RESULTS OF THE OBSERVATIONS OF EACH STAR, ETC. — continued.

No.	Date of Observation.	Observed Appt. R. A.			Reduction to 1879.0.	Observed Appt. Dec.			Reduction to 1879.0.	Mean R. A. 1879.0.	Mean Dec. 1879.0.	Adopted Mean R. A. 1879.0.			Adopted Mean Dec. 1879.0.		
	1879.	h	m	s	s	°	′	″	″	s	″	h	m	s	°	′	″
85	July 16	18	3	53.76	—3.344	36	23	27.82	—4.76	50.42	20.06						
	July 24		3	53.61	—3.315		23	29.15	—5.80	50.30	23.35						
	July 25		3		—3.307		23	29.02	—6.05		22.97						
	July 27		3	53.83	—3.270		23	31.03	—6.99	50.56	24.04	18	3	50.43	36	25	23.07
	Aug. 17		3		—3.005		23	31.72	—9.77		21.95						
86	July 19	18	4	41.39	—3.854	3	18	4.20	—0.92	37.54	3.28	18	4	37.63	3	18	4.00
	July 30		4	41.56	—3.830		18	6.98	—2.27	37.73	4.71						
87	July 26	18	4			16	27	20.06	—3.90		16.16						
	July 31		4	48.17	—3.578		27	24.10	—4.74	44.59	19.36	18	4	44.59	16	27	17.76
88	July 14	18	17	1.46	—3.718	11	58	18.04	—1.91	57.74	16.13						
	July 17*		17	1.32	—3.723		58	18.31	—2.46	57.60	15.85						
	July 26		17				53	19.69	—4.00		15.69	18	16	57.68	11	58	16.10
	July 30		17	1.36	—3.694		58	21.38	—4.64	57.66	15.74						
89	July 16	18	19	53.43	—3.796	7	57	58.23	—2.08	49.63	56.15						
	July 18*		19	53.22	—3.797		57	57.13	—2.40	49.42	54.73	18	19	49.56	7	57	55.44
90	Aug. 18	18	24	29.52	—3.485	16	54			26.04		18	24	26.04			
91	July 8	18	25	45.24	—3.632	16	50	46.37	—1.47	41.61	44.90						
	July 17*		25	45.09	—3.660		49	46.95	—3.83	41.43	43.12	18	25	41.56	16	50	43.96
	Aug. 18		25	45.06	—3.485		51	52,69	—3.83	41.58	43.86						

92	July 16	18	28	15.83	—3.476	30	27	54.70	—4.16	12.35	50.54						
	July 18*		28	15.61	—3.476		27	55.25	—4.69	12.13	50.56						
	July 29		28	15.88	—3.433		27	59.15	—7.37	12.45	51.78	18	28	12.37	30	27	51.06
	July 30		28	15.87	—3.426		27	58.95	—7.59	12.44	51.36						
93	Aug. 4	18	30	45.39	—3.772	9	1	46.53	—5.84	41.62	40.79	18	30	41.62	9	1	40.79
94	July 31	18	30	49.86	—3.836	6	34	43.42	—4.90	46.02	38.52	18	30	45.98	6	34	38.50
	Aug. 9		30	49.73	—3.793		34	44.53	—6.04	45.94	38.49						
95	July 15	18	31	26.43	—3.969	—0	24	35.01	—2.00	22.46	37.01						
	Aug. 15		31	26.86	—3.932		24	30.77	—7.23	22.93	38.00	18	31	22.69	—0	24	37.50
96	July 17*	18	32	14.32	—3.446	33	22	9.02	—4.69	10.87	4.33						
	Aug. 1		32	14.36	—3.379		22	13.17	—8.48	10.98	4.69	18	32	10.98	33	22	4.25
	Aug. 18		32	14.22	—3.184		22	15.75	12.03	11.04	3.72						
97	July 8	18	39	22.40	—3.456	31	48	36.39	—2.35	18.94	34.04						
	July 15		39	21.98	—3.472		48	36.09	—4.38	18.51	31.71						
	July 16		39	22.28	—3.477		48	37.73	—4.58	18.80	33.15	18	39	18.78	31	48	32.70
	Aug. 9		39	22.24	—3.356		48	42.35	—10.43	18.88	31.92						
98	July 29	18	41	15.42	—3.527	26	32	8.75	—7.58	11.89	1.17						
	Aug. 4		41	15.44	—3.493		32	8.22	—8.89	11.95	59.33	18	41	11.92	26	32	0.25
99	July 31	18	42	31.80	—3.112	54	46	19.58	—9.62	28.69	9.96						
	Aug. 1		42	31.79	—3.097		46	19.12	—9.91	28.69	9.21	18	42	28.72	54	46	10.34
	Aug. 11		42	31.70	—2.908		46	22.25	—10.40	28.79	11.85						
100	Aug. 17	18	43	26.64	—3.281	31	37	36.92	—12.21	23.26	24.71	18	43	23.30	31	27	23.30
	Aug. 19		43	26.59	—3.255		37	34.48	—12.58	23.34	21.90						
101	Aug. 9	18	44	19.65	—3.493	24	54	45.40	—9.86	16.16	35.54						
	Aug. 20		44	19.61	—3.379		54	46.77	—11.80	16.23	34.97	18	44	16.19	24	54	35.25
102	Aug. 4	18	46	32.84	—3.728	13	49	24.03	—7.62	28.11	16.41	18	46	28.14	13	49	17.36
	Aug. 22		46	32.76	—3.588		49	28.52	—10.20	28.17	18.32						

TABLE GIVING THE SEPARATE RESULTS OF THE OBSERVATIONS OF EACH STAR, ETC.—continued.

No.	Date of Observation.	Observed Appt. R. A.			Reduction to 1879 0.	Observ d Appt. Dec.			Reduction to 1879.0.	Mean R. A. 1879.0.	Mean Dec. 1879.0.	Adopted Mean R. A. 1879.0.			Adopted Mean Dec. 1879.0.		
	1879.	h	m	s	s	°	′	″	″	s	″	h	m	s	°	′	″
103	July 29..........	18	50	49.46	—3.686	17	57	24.71	—7.27	45.77	17.44						
	July 31..........		50	49.57	—3.680		57	25.52	—7.66	45.89	17.86	18	50	45 83	17	57	17.65
104	Aug. 9..........	18	52	55.30	—3.659	17	12	6.33	—9.33	51.64	57.00						
	Aug. 11..........		52	55.34	—3.646		12	6.78	—9.67	51.69	59.11	18	52	51.66	17	11	56.90
	Aug. 20..........		52	55.23	—3.567		12	7.53	—10.95	51.66	56.58						
105	Aug. 4..........	18	53	33.25	—3.645	19	37	58.82	—8.77	29.61	50 05	18	53	29.46	19	37	49.79
	Aug. 25..........		53	32.78	—3.464		37	61.76	—12.22	29.32	49.54						
106	Aug. 17..........	18	54	52.17	—3.435	26	4	2.28	—12.09	49.74	50.19						
	Sept. 5..........		54	52.91	—3.147		4	4.02	—14.65	49.76	49.37	18	54	49.75	26	3	49.78
107	Aug. 22..........	18	56	55.77	—2.347	65	5	59.88	—15.73	53.42	44.15	18	55	53.42	65	5	44.15
108	Aug. 28..........	18	56	13 37	—3.298	20	39	54.96	—12.99	10.07	41 97	18	56	10.07	20	39	41.97
109	July 31..........	18	57	14.27	—4.583	50	21	54.45	—9.83	·9 69	44.62	18	57	9.69	50	21	44.62
110	Aug. 9..........	18	57	28.69	—3.982	1	38		—7.25	24.71							
	Aug. 11..........		57	28.96	—3.972		38	49.54	—7.45	24.99	42.09	18	57	24 82	1	37	41.21
	Aug. 25..........		57	28.61	—3.865		37	49.01	—8.67	24.75	40 34						
111	Aug. 1..........	18	57	39.91	—3 669	19	29	15.33	—8.40	36.22	6.93						
	Aug. 20..........		57	39.67	—3.541		29	19.39	—11.75	36.13	7.64	18	57	36.17	19	29	7.29
112	Aug. 4..........	19	1	6.45	—3.719	16	42		—8.98	2.73	....	19	1	2.73	....		

113	July 29	19	2	35.44	—3.732	16	40	34.83	—7.90	31.71	26.93						
	Aug. 4		2	35.45	—3.719		40	33.50	—8.98	31.73	24.52	19	2	31.65	16	40	26.24
	Aug. 9		2	35.21	—3.699		40	37.15	—9.87	31.51	27.28						
114	July 16	19	5	37.99	—3.954	2	20	10.89	—4.89	34.04	6.00	19	5	34.04	2	20	6.00
115	July 31	19	6	56.44	—2.933	82	11	45.51	—8.93	53.51	36.58						
	Aug. 18		6	54.34	—1.019		11	51.28	—14.18	53.32	37.10	19	6	53.41	82	11	36.84
116	July 18	19	10	46.25	—3.539	30	19	5.17	—6.41	42.71	58.76						
	Aug. 1		10	46.37	—3.535		19	5.98	—9.82	42.84	56.16						
	Aug. 4		10	46.31	—3.521		19	6.20	—10.56	42.79	55.64	19	10	42.79	30	18	56.94
	Aug. 17		10	46.25	—3.421		19	10.70	—13.49	42.83	57.21						
117	July 26	19	11		...	14	20	0.36	—7.55	...	52.81						
	July 29		10	58.12	—3.788		20	1.95	—8.14	54.33	53.81	19	10	54.33	14	19	52.53
	Aug. 19		10	58.03	—3.701		20	2.60	—11.64	54.33	50.96						
118	July 16	19	20	50.49	—3.777	12	46	59.56	—6.06	46.71	53.50						
	July 20		20	50.54	—3.802		46	60.37	—6.89	46.74	53.48	19	20	46.71	12	46	53.05
	Aug. 9		20	50.50	—3.821		46	62.72	—10.55	46.68	52.17						
119	July 19	19	22	3.71	—3.776	14	2	26.08	—6.77	59.93	19.31						
	July 26		22		...		2	25.42	—8.20	...	17.22	19	22	59.93	14	2	19.03
	July 30		22	3.67	—3.814		2	28.73	—8.98	59.86	19.75						
	Aug. 11		22	3.79	—3.794		2	30.95	—11.12	60.00	19.83						
120	July 29	19	23	52.43	—3.811	14	21	2.05	—8.91	48.62	53.14						
	July 31		23	52.51	—3.812		21	2.93	—9.29	48.70	53.64	19	23	48.63	14	20	52.22
	Aug. 19		23	52.32	—3.748		21	2.40	—12.52	48.57	49.88						
121	July 20	19	30	0.20	—3.768	15	20	49.54	—7.44	56.43	42.10						
	July 30		30	0.24	—3.804		20	53.63	—9.52	56.44	44.11	19	29	56.38	15	20	42.63
	Aug. 9		30	0.08	—3.799		20	53.06	—11.37	56.28	41.69						
122	July 26	19	30		...	83	13	32.13	—7.15	...	24.98						
	Aug. 11		30	34.41	—2.339		13	38.70	—12.36	32.07	26.34	19	30	32.07	83	13	25.66

TABLE GIVING THE SEPARATE RESULTS OF THE OBSERVATIONS OF EACH STAR, ETC.—continued.

No.	Date of Observation.	Observed Appt. R. A.	Reduction to 1879.0.	Observed Appt. Dec.	Reduction to 1879.0.	Mean R. A. 1879.0.	Mean Dec. 1879.0.	Adopted Mean R. A. 1879.0.	Adopted Mean Dec. 1879.0.
	1879.	h m s	s	° ′ ″	″	s	″	h m s	° ′ ″
123	July 24..........	19 31 15.12	−3.456	50 58 49.86	−9.79	11.66	40.07	....	....
	July 31..........	31 15.17	−3.344	58 49.86	−10.43	11.88	39.43	19 31 11.80	50 58 38.99
	Aug. 19..........	31 15.04	−3.117	58 53.52	−16.05	11.92	37.47	....	....
124	July 20..........	19 35 33.27	−3.800	13 32 16.88	−7.73	29.47	9.15	19 35 29.45	13 32 9.10
	Aug. 17..........	35 33.25	−3.814	32 21.95	−12.90	29.44	9.05	....	....
125	July 26..........	19 38	....	32 8 36.22	−8.28	....	27.94	....	....
	July 30..........	38 8.73	−3.576	8 37.30	−10.38	5.15	26.92	19 38 5.26	32 8 26.54
	Aug. 19..........	38 8.85	−3.482	8 40.13	−15.38	5.37	24.75	....	....
126	July 20..........	19 45 58.50	−3.553	32 36 40.70	−7.77	54.95	32.93	....	....
	Aug. 1..........	45 58.53	−3.587	36 43.07	−11.20	54.94	31.87	19 45 54.94	32 36 32.40
127	July 26..........	19 47	....	24 41 6.44	−9.64	....	56.80	....	....
	Aug. 17..........	46 59.87	−3.654	41 10.87	−14.76	56.22	56.11	19 46 56.17	24 40 56.25
	Aug. 27..........	46 59.69	−3.573	41 12.52	−16.68	56.12	55.84	....	....
128	July 30..........	19 48 23.77	−3.440	46 43 9.30	−10.48	20.33	58.82	19 48 20.33	46 42 58.00
	Aug. 18..........	48 23.63	−3.292	43 13.38	−16.19	20.34	57.19	....	....
129	Aug. 4..........	19 48 36.65	−3.416	47 37 23.87	−12.06	33.23	11.81	....	....
	Aug. 19..........	48 36.50	−3.277	37 27.09	−16.49	33.24	10.60	19 48 33.23	47 37 11.79
	Aug. 22..........	48 36.45	−3.235	37 30.27	−17.31	33.22	12.96	....	....
130	Aug. 11..........	19 50 26.55	−3.520	36 40 51.31	−14.13	23.03	37.18	....	....
	Aug. 25..........	50 26.53	−3.398	40 55.32	−17.61	23.13	37.71	19 50 23.08	36 40 37.44

131	July 20.........	19 51 58.31	—3.579	30 40	—8.03	52.73	....	19 51 52.73	....
132	July 20...... ...	19 53 53.62	—3.574	30 39 31.13	—7.57	50.05	23.56	....	....
	July 26.........	53	....	39 32.41	—9.80	....	22.61	....	....
	Aug. 1.	53 53.66	—3.628	39 32.37	—11.46	50.03	20 91	19 53 50.16	30 39 22.28
	Aug. 17.........	53 53.81	—3.406	39 37.58	—15.52	50.40	22.06	....	....
133	Aug. 18.........	19 56 28.48	—3.945	10 24 27.89	—14.49	24.54	13.40	19 56 24.54	10 24 13.40
134	Aug. 4.........	19 57 6.46	—3.653	29 34	....	2.81	....	19 57 2.81	....
135	July 29.........	19 58 42.59	—3.641	29 34 39.31	—10.83	38.95	28.51	....	....
	Aug. 4.........	58 42 64	—3.653	34 39.61	—12 44	38.99	27.17	19 58 38.96	29 34 28.05
	Aug. 27.........	58 42.47	—3.536	34 46.32	—17.84	38.93	28.48	....	....
136	July 26...... ...	19 59	....	31 52 43.42	—9.96	....	33.46	....	....
	Aug. 9.........	59 55.07	—3.621	52 48.98	—13.81	51.45	35.17	19 59 51.47	31 52 34.60
	Aug. 17....	59 55.09	—3.586	52 51.01	—15.84	51.50	35.17	....	....
137	July 30.........	19 59 56.40	—3.847	15 9 33.87	—11 20	52.55	22.67	....	....
	July 31.........	59 56.34	—3.851	9 30.79	—11.41	52.49	19.88	....	....
	Aug. 11.........	59 56.33	—3.869	9 33.58	—13.57	52.46	20.01	19 59 52.48	15 9 20.40
	Sept. 6....	59 56.12	—3.705	9 37.09	—17.54	52 42	19.55	....	....
138	Aug. 1.........	20 2 56.04	—3.937	10 22 39.13	—11.69	52.10	27.44	....	....
	Aug. 18.........	2 55.97	—3 945	22 42.21	—14.49	52.03	27.52	20 2 52.01	10 22 27.47
	Aug. 22.........	2 55.84	—3.927	22 42.83	—15.37	51.91	27.46	....	....
139	Aug. 4.........	20 3 7.17	—3.607	34 4 31.95	—12.58	3.56	19.37	....	....
	Aug. 25.........	3 7.02	—3.502	4 38.09	—17.97	3.52	20.11	20 3 3.54	34 4 19.74
140	July 29.........	20 6 7.33	—3.756	21 31 10.73	—11.25	3.56	59.48	....	....
	Aug. 9.........	6 7.40	—3.782	31 13.18	—13.81	3.62	59.37	....	....
	Aug. 11.........	6 7.54	—3.781	31 12.53	—14.25	3.76	58.28	20 6 3.64	21 30 58.83
	Aug. 17.........	6 7.46	—3.766	31 14.58	—15.52	3.69	59.06	....	....
	Aug. 27.........	6 7.28	—3.707	31 16.03	—18.07	3.57	57.96	....	....

TABLE GIVING THE SEPARATE RESULTS OF THE OBSERVATIONS OF EACH STAR, ETC. — continued.

No.	Date of Observation.	Observed Appt. R. A.			Reduction to 1879.0.	Observed Appt. Dec.			Reduction to 1879.0.	Mean R. A. 1879.0.	Mean Dec. 1879.0.	Adopted Mean R. A. 1879.0.			Adopted Mean Dec. 1879.0.		
		h	m	s	s	°	′	″	″	s	″	h	m	s	°	′	″
	1879.																
141	Aug. 1........	20	11	7.37	—3.770	21	56		—12.29	3.60	....	20	11	3.60	....		
142	Aug. 1........	20	15	28.13	—3.774	21	53	54.20	—12.38	24.36	41.82	....			....		
	Aug. 22........		15	28.03	—3.766		53	59.34	—17.28	24.26	42.06	20	15	24.30	21	53	42.04
	Aug. 25........		15	28.03	—3.750		53	59.83	—17.59	24.28	42.24	....			....		
143	Aug. 4........	20	17	17.72	—3.902	14	8	4.62	—13.17	13.82	51.45	20	17	13.75	14	79	51.60
	Aug. 18........		17	17.60	—3.914		10	7.53	—15.77	13.69	51.76	....			....		
144	Aug. 11........	20	18	11.96	—3.516	45	24	39.22	—14.82	8.44	24.40	....			....		
	Aug. 27........		18	11.75	—3.379		24	44.91	—19.46	8.37	25.45	20	18	8.40	45	24	24.92
145	Aug. 17........	20	19	16.38	—3.587	37	5	27.99	—16.68	12.79	11.31	20	19	12.75	37	5	10.94
	Sept. 5........		19	16.13	—3.408		5	31.86	—21.29	12.71	10.57	....			....		
146	Aug. 20........	20	19	31.42	—3.242	63	35	49.65	—17.04	28.18	32.61	....			....		
	Sept 10........		19	30.82	—2.670		35	53.39	—23.21	28.15	30.18	20	19	28.16	63	35	31.40
147	Aug. 25........	20	20	23.38	—3.782	21	1	13.96	—16.76	19.60	56.20	....			....		
	Sept. 6........		20	23.22	—3.685		1	17.12	—19.79	19.54	57.33	20	20	19.57	21	0	56.76
148	Aug. 1........	20	24	11.98	—3.740	25	25		—12.65	8.24	....	....			....		
	Aug. 4........		24	11.92	—3.754		25		—15.43	8.17	....	20	24	8.20	....		

149	July 29.........	20	26	51.26	—3.725	25	24	0.99	—11.96	47.54	49.03	....			....			
	Aug. 1........		26	51.35	—3.743		24	0.95	—12.75	47.61	48.20	....			....			
	Aug. 4.........		26	51.32	—3.757		24	0.67	—13.53	47.56	47.14	20	26	47.57	25	23	48.31
	Aug. 17.........		26	51.37	—3.767		24	5.60	—16.70	47.60	48.90	....			....			
	Aug. 20.........		26	51.28	—3.759		24	5.61	—17.35	47.52	48 26	....			....			
150	Aug. 22.........	20	30	25.26	—3.832	21	25		....	21.43	....	20	30	21.43	....			
151	Aug. 4.........	20	33	52.05	—3.817	21	23	42.52	—13.91	48.23	28.61	....			....			
	Aug. 11.........		33	52.01	—3.841		23	44.72	—15.54	48.17	29.18	....			....			
	Aug. 22........		33	52.00	—3.832		23	48.07	—17.90	48 17	30.17	20	33	48.18	21	23	29.68
	Aug. 27.........		33	52.00	—3.828		23	49.50	—18.73	48.17	30.77	....			....			
152	Aug. 20.........	20	35	52.90	—3.571	43	2	13.90	—17.94	49.33	55.96	....			....			
	Aug. 25.........		35	52.92	—3.534		2	15.66	—19.37	49.39	56.29	20	35	49.37	43	1	56.20
	Sept. 5.........		35	52.78	—3.404		2	18.69	—22.35	49.38	56.34	....			....			
153	Aug. 5.........	20	41	17.03	—3.557	56	3	7.17	—12.12	13.47	55.05	....			....			
	Aug. 20.........		41	17.10	—3.486		3	13.45	—17.60	13.61	55.85	20	41	13.50	56	2	55.61
	Sept. 6.........		41	16.65	—3.219		3	18.73	—22.80	13.43	55.93	....			....			
154	Aug. 4.........	20	42	34.85	—3.557	56	3		....	31.29	......	20	42	31.29	....			
155	Aug. 22........	20	43	53.85	—3.552	47	23	30.17	—18.61	50.30	11.56	....			....			
	Aug. 27........		43	53.73	—3.517		23	31.57	—20.11	50.21	11.46	20	43	50.28	47	23	11.19
	Sept. 25.......		43	53.36	—3.023		23	37.69	—27.15	50.34	10.54	....			....			
156	Aug. 25.........	20	45	7.02	—3.489	51	28	1.79	—19.42	3.53	42.37	....			....			
	Sept. 5........		45	6.84	—3.334		28	5.47	—22.34	3.51	43.13	20	45	3.54	51	27	42.39
	Sept. 10.........		45	6.63	—3.260		28	5.65	—23.98	3.57	41.67	....			....			
157	Aug. 20.........	20	47	0.19	—3.927	17	34	40.14	—17.97	56.26	22.17	....			....			
	Sept. 6.........		47	0.07	—3.856		34	43.26	—20.88	56.21	22.38	20	47	56.26	17	34	21.85
	Sept. 24.........		46	59.98	—3.669		34	44.10	—23.10	56.31	21.00	....			....			
158	Aug. 22.........	20	49	3.59	—3.728	32	58	61.03	—18.86	59.86	42.17	....			....			
	Sept. 25.........		49	3.21	—3.379		59	7.81	—25.91	59.83	41.99	20	48	59.84	32	58	42.03

TABLE GIVING THE SEPARATE RESULTS OF THE OBSERVATIONS OF EACH STAR, ETC.—continued.

No.	Date of Observation.	Observed Appt. R. A.	Reduction to 1879.0.	Observed Appt. Dec.	Reduction to 1879.0.	Mean R. A. 1879.0.	Mean Dec. 1879.0.	Adopted Mean R. A. 1879.0.	Adopted Mean Dec. 1879.0
	1879.	h m s	s	° ′ ″	″	s	″	h m s	° ′ ″
159	Aug. 4........	20 51 12.96	—3.651	40 43	—13.39	9.31	....	20 51 9.31	....
160	Aug. 20.........	20 54 59.77	—3.927	18 51 53.01	—17.88	55.84	35.13	....	....
	Aug. 27........	54 59.83	—3.920	51 55.95	—19.80	55.91	36.15	....	....
	Sept. 24........	54 59.47	—3.689	51 56.88	—23.85	55.78	33.03	20 54 55 77	18 51 34.85
	Sept. 25.	54 59.64	—3.676	51 59.05	—23.95	55.96	35.10	....	....
161	Aug. 20.	21 1 29.40	—3.800	30 42 18.73	—18.73	25.60	60.00	....	....
	Aug. 25...... ...	1 29.44	—3.792	42 19.73	—19.99	25.65	59.74	....	....
	Sept. 24.........	1 29.10	—3.523	42 22.76	—26.07	25 58	56.69	21 1 25 60	30 41 59.01
	Sept. 25.	1 29.10	—3.506	42 25.85	—26.22	25.59	59.63	....	....
162	Aug. 20.........	21 13 18.55	—3.694	53 29 39.80	—17.93	14.86	21.87	....	....
	Aug. 25........	13 18.53	—3.682	29 42 21	—19.62	14.85	22.59	....	....
	Aug. 27.........	13 18.44	—3.654	29 43.58	—20.26	14.79	23.32	21 13 14.85	53 29 21.99
	Sept. 10.........	13 18.29	—3.487	29 45.22	—24.54	14.80	20.68	....	....
	Sept. 26.........	13 18.12	—3.172	28 50.20	—28.70	14.95	21.50	....	....
163	Aug. 22.........	21 14 48.21	—3.939	21 31 12.21	—19.70	44.27	52.51	....	....
	Sept. 5.........	14 48.15	—3.911	31 14.65	—22.48	44.24	52.17	....	....
	Sept. 12.	14 48.11	—3.865	31 14.60	—23.68	44.24	50.92	21 14 44.21	21 30 51.80
	Sept. 24.........	44 47.83	—3.752	31 17.00	—25.41	44.08	51.59	....	....
164	Sept. 6.........	21 16 19.97	—3.781	32 6 20.26	—23.32	16.19	56.94	....	....
	Sept. 11...... ...	16 20.02	—3.742	6 21.36	—24.42	16.28	56.94	21 16 16.22	32 5 57.05
	Sept. 25.........	16 19.73	—3.585	6 24.35	—27.07	16.18	57.28	....	....

165	Aug. 22.........	21	22	37.75	—3.752	48	18	53.43	—18.99	34.00	34.44	....	....
	Sept. 9		22	37.40	—3.629		18	57.80	—24.47	33.77	33.33	....	....
	Sept. 10.........		22	37.44	—3.618		18	56.53	—24.74	33.82	31.79	21 22 33.90	48 18 32.77
	Sept. 20.........		22	37.47	—3.476		18	59.54	—27.38	33.99	32.16	....	....
	Sept. 24.........		22	37.32	—3.405		18	60.46	—28.33	33.92	32.13	....	....
166	Sept. 5.........	21	23	31.94	—3.942	21	39	26.22	—22.75	28.00	3.47	....	....
	Sept. 25.........		23	31.84	—3.788		39	30.79	—25.99	28.05	4.80	21 23 28.02	21 39 4.13
167	Aug. 25.........	21	25	22.54	—4.092	11	36	45.28	—20.60	18.45	24.68	....	....
	Aug. 27.........		25	22.65	—4.094		36	45.58	—20.91	18.56	24.67	....	....
	Sept. 6.........		25	22.48	—4.081		36	46.04	—22.34	18.40	23.70	21 25 18.49	11 36 23.89
	Sept. 12.........		25	22.51	—4.054		36	45.85	—23.09	18.46	22.76	....	....
	Sept. 26.........		25	22.43	—3.867		36	48.33	—24.70	18.56	23.63	....	....
168	Aug. 22.........	21	28	43.80	—3.781	49	26	47.71	—18.94	40.02	28.77	....	....
	Sept. 11.........		28	43.69	—3.648		26	53.79	—25.10	40.04	28.69	21 28 39.99	49 26 28.05
	Sept. 24.........		28	43.35	—3.450		26	55.21	—28.52	39.90	26.69	....	....
169	Sept. 5.........	21	47	59.78	—4.053	19	6	17.98	—23.68	55.73	54.30	....	....
	Sept. 11.........		47	59.84	—4.037		6	18.62	—24.71	55.80	53.91	....	....
	Sept. 17*.........		47	60.18	—4.009		6		—25.64	56.17	....	21 47 55.75	19 5 53.98
	Sept. 18.........		47	59.76	—3.997		6	19.02	—25.84	55.76	53.18	....	....
	Oct. 1.........		47	59.30	—3.799		6	21.10	—26.55	55.50	54.55	....	....
170	Sept. 9.........	21	50	48.55	—4.036	20	40	18.91	—24.56	44.51	54.35	....	....
	Sept. 10.........		50	48.54	—4.033		40	18.72	—24.73	44.51	53.99	....	....
	Sept. 12.........		50	48.57	—4.027		40	20.76	—25.08	44.54	55.68	21 50 44.56	20 39 54.59
	Sept. 25.........		50	48.58	—3.945		40	21.91	—27.07	44.64	54.84	....	....
	Sept. 26.........		50	48.55	—3.937		40	22.74	—27.20	44.61	55.24	....	....
	Oct. 3.........		50	48.43	—3.869		40	21.51	—28.04	44.56	53.47	....	....
171	Sept. 5.........	21	58	7.69	—3.926	44	4	24.09	—23.75	3.76	60.34	....	....
	Sept. 9.........		58	7.72	—3.908		4	24.75	—24.91	3.81	59.84	....	....
	Sept. 11.........		58	7.67	—3.897		4	27.05	—25.47	3.77	61.58	....	....
	Sept. 22.........		58	7.55	—3.802		4	29.86	—28.39	3.75	61.47	21 58 3.79	44 4 0.80
	Sept. 24.........		58	7.59	—3.789		4	30.35	—28.87	3.80	61.48	....	....
	Sept. 26.........		58	7.59	—3.755		4	29.47	—29.35	3.84	60.12	....	....

TABLE GIVING THE SEPARATE RESULTS OF THE OBSERVATIONS OF EACH STAR, ETC.—continued.

No.	Date of Observation.	Observed Appt. R A.			Reduction to 1879.0.	Observed Appt. Dec.			Reduction to 1879.0.	Mean R.A. 1879.	Mean Dec. 1879.0.	Adopted Mean R. A. 1879.0.			Adopted Mean Dec. 1879.0.		
	1879.	h	m	s	s	°	′	″	″	s	″	h	m	s	°	′	″
172	Sept. 9	22	4	45.41	—4.183	11	2	18.43	—24.61	41.23	53.82						
	Sept. 11			45.39	—4.181			19.81	—24.85	41.21	54.96						
	Sept. 18			45.34	—4.163			20.00	—25.68	41.18	54.32	22	4	41.19	11	1	54.51
	Sept. 24			45.33	—4.133			21.47	—26.28	41.20	55.19						
	Sept. 26			45.33	—4.120			21.59	—26.44	41.21	55.15						
	Oct. 6			45.14	—4.039			20.85	—27.20	41.10	53.65						
173	Sept. 5	22	7	57.18	—4.322	69	32		—21.66	52.86							
	Sept. 6			57.29	—4.311			29.21	—22.03	52.98	7.18						
	Sept. 10			57.08	—4.267			30.10	—23.20	52.8[illegible]	6.90	22	7	53.00	69	32	6.86
	Sept. 12			57.26	—4.219			31.69	—24.17	53.04	7.52						
	Sept. 20			57.19	—4.044			32.69	—26.93	53.15	5.76						
	Sept. 25			57.05	—3.907			35.47	—28.55	53.14	6.92						
174	Sept. 9	22	22	12.46	—4.057	39	12	1.58	—25.16	8.40	36.42						
	Sept. 10			12.41	—4.057			3.35	—25.43	8.35	37.92						
	Sept. 24			12.44	—3.992			7.27	—29.01	8.45	38.26	22	22	8.42	39	11	37.64
	Oct. 1			12.37	—3.927			8.85	—30.57	8.44	38.28						
	Oct. 3			12.35	—3.910			8.31	—30.98	8.44	37.33						
175	Sept. 11	22	22	57.76	—4.519	70	9	41.08	—23.47	53.24	17.61						
	Sept. 18			57.49	—3.381			42.65	—25.94	53.11	16.71	22	22	53.17	70	9	17.49
	Sept. 25			57.42	—4.240			46.52	—28.34	53.18	18.18						
	Oct. 9			56.95	—3.793			49.81	—32.69	53.16	17.12						

176	Sept. 12.	22	23	34.15	—4.106	26	9	7.49	—26.15	30.04	41.34						
	Sept. 20.			34.20	—4.086		9	8.72	—27.71	30.11	41.01						
	Oct. 6.			34.07	—3.978		9	11.90	—30.31	30.09	41.59	22	23	30.08	26	8	41.77
	Oct. 10.			34.01	—3.940		9	13.23	—30.86	30.07	43.16						
177	Sept. 10.	22	34	10.13	—4.119	36	58	12.29	—25 53	6.01	46.76						
	Sept. 11.			10.05	—4.119			14.07	—25.80	5 93	48.27						
	Sept. 12.			10.17	—4.119			11.98	—26.06	6.05	45.92	22	34	5.99	36	57	46.77
	Sept. 20.			10.11	—4.101			13.65	—28 08	6.01	45.57						
	Sept. 24.			9 98	—4.081			16.35	—29 03	5.90	47.32						
178	Oct. 1.	22	34	48.71	—4.053		54	22 32	—30.77	44.66	31.55	22	34	44.66	36	53	51.55
	Oct. 9.			9.99	—3.954				—32.14	6.04							
179	Sept. 10.	22	49	29.12	—4.185	36	26	20.26	—25.53	24.94	54.73						
	Sept. 12.			29.26	—4.193			22.15	—26.06	25.07	56.09						
	Sept. 20.			29.17	—4.193			22.93	—28.08	24.98	54.85	22	49	25.08	36	25	55.66
	Sept. 26.			29.34	—4.172			25.31	—29.50	25.17	55.81						
	Oct. 3.			29 35	—4.132			27.82	—31.02	25.22	56.80						
180	Sept. 11	22	50	10.51	—4.193	35	42	48.15	—25.84	6.32	22.31						
	Sept. 24.			10.61	—4.136			52.24	—29.04	6.47	23.20						
	Oct. 6.			10.54	—4.115			53.81	—31.58	6.43	22.23	22	50	6.41	35	42	22.24
	Oct. 9.			10.53	—4.092			54.18	—32.16	6.44	22.02						
181	Oct. 10.	22	52	1.25	—4.083		44	2.93	—32.36	57.17	30.57	22	51	57.17	35	43	30.57
182	Sept. 18.	22	54	0.41	—4.345	52	0	45.17	—26.76	56 07	18.41						
	Oct. 3.			0.25	—4.237		0	51.18	—31.22	56.01	19.96	22	53	56.07	52	0	19.33
	Oct. 11.			0.28	—4.141		0	52.94	—33.32	56.14	19.62						
183	Sept. 10.	22	55	0.36	—4.205	30	26	27.25	—25.87	56.16	1.38						
	Sept. 26.			0.48	—4.208			31.45	—29.38	56.27	2.07						
	Oct. 6.			0.40	—4.158			31.72	—31.25	56.24	0.47	22	54	56.21	30	26	1.39
	Oct. 9.			0.33	—4.139			32.57	—31.75	56.19	0.82						
	Oct. 10.			0.35	—4.131			33.61	—31.91	56.23	1.70						
	Oct. 15.			0.27	—4.089			34.61	—32.68	56.18	1.93						

TABLE GIVING THE SEPARATE RESULTS OF THE OBSERVATIONS OF EACH STAR, ETC. — continued.

No.	Date of Observation.	Observed Appt. R. A.	Reduction to 1879.0.	Observed Appt. Dec.	Reduction to 1879.0.	Mean R. A. 1879.0.	Mean Dec. 1879.0.	Adopted Mean R. A. 1879.0.	Adopted Mean Dec. 1879.0.
	1879.	h m s	s	° ′ ″	″	s	″	h m s	° ′ ″
184	Sept. 24	22 55 3.82	—4.391	56 18 15.43	—28.38	59.43	47.05		
	Oct. 1	3.72	—4.328	17.78	—30.53	59.39	47.25	22 54 59.39	56 17 47.13
	Oct. 20	3.38	—4.033	22.66	—35.58	59.35	47.08		
185	Sept. 12	22 56 31.27	—4.230	22 41 49.40	—26.63	27.04	22.77		
	Sept. 20	31.21	—4.242	49.64	—28.10	26.97	21.54	22 56 27.00	22 41 22.15
186	Sept. 9	23 25 34.27	—4.287	28 0 21.38	—25.69	29.98	55.69		
	Sept. 12	34.28	—4.309	23.07	—26.38	29.97	56.69		
	Oct. 1	34.29	—4.358	28.73	—30.24	29.93	58.49	23 25 30.00	27 59 56.72
	Oct. 9	34.42	—4.339	28.51	—31.62	30.08	56.89		
	Oct. 20	34.30	—4.279	29.71	—33.19	30.02	56.52		
	Nov. 1	34.22	—4.178	30.56	—34.52	30.04	56.04		
187	Sept. 20	23 27 55.66	—4.348	20 10 51.31	—28.31	51.31	23.00		
	Oct. 3	55.81	—4.361	54.26	—30.25	51.45	24.01		
	Oct. 6	55.78	—4.357	52.83	—30.64	51.42	22.19		
	Oct. 10	55.65	—4.345	54.32	—31.12	51.31	23.20	23 27 51.36	20 10 22.86
	Oct. 11	55.68	—4.342	53.08	—31.24	51.34	21.82		
	Oct. 15	55.67	—4.326	54.63	—31.67	51.34	22.96		
188	Sept. 20	23 34 42.55	—4.429	36 3 25.22	—27.56	38.12	57.66		
	Oct. 1	42.46	—4.448	28.90	30.18	38.01	58.72		
	Oct. 3	42.53	—5.446	30.65	—30.62	38.08	60.03		
	Oct. 6	42.39	—4.441	30.10	—31.28	37.95	58.82	23 34 38.05	36 2 59.02
	Oct. 9	42.52	—4.433	30.70	—31.89	38.09	58.81		
	Oct. 10	42.43	—4.429	32.40	—32.11	38.00	60.29		
	Oct. 11	42.51	—4.424	31.12	—32.29	38.09	58.83		

189	Sept. 20	23	41	12.24	—4.894	56	47	12.83	—25.49	7.35	47.34	.....			.....		
	Oct. 6			12.31	—4.887			16.29	—30.63	7.42	45.66	.....			.....		
	Oct. 9			12.85	—4.872			17.08	—31.54	7.48	45.54	23	41	7.39	56	46	46.26
	Oct. 15			12.15	—4.822			19.79	—33.27	7 33	46.52	.....			.....		
190	Oct. 1	26	43	40.51	—4.500	35	45	44.27	—30.00	36.31	14.27	.....			.....		
	Oct. 3			40.57	—4.500			47.31	—30.43	36.07	16.88	.....			.....		
	Oct. 10			40.54	—4.491			47.53	—31.92	36.05	15.61	23	43	36.04	35	45	15.45
	Oct. 11			40.43	—4.488			47.59	—32.11	35.95	15.48	.....			.....		
	Oct. 20			40.60	—4.448			49.14	—33 78	36.15	15.36	.....			.....		
	Oct. 25			40.43	—4.414			49.74	—34.62	36.02	15.12	.....			.....		
191	Oct. 3	23	49	32.02	—4.701	46	41	29.65	—29.94	27.32	59.71	.....			.....		
	Oct. 6			32.09	—4.699		41	28.00	—30.76	27.39	57.24	.....			.....		
	Oct. 9			32.17	—4.694			29.81	—31.54	27.48	58.27	23	49	27.38	46	40	58.61
	Oct. 11			32.12	—4.687			30.93	—32.06	27.43	58.87	.....			.....		
	Oct. 15			31.97	—4.669			32.00	—33.04	27.30	58.96	.....			.....		
192	Oct. 1	23	50	36.08	—4.452	21	58	58.64	—29.95	31.63	28.69	.....			.....		
	Oct. 10			36.10	—4.456			60.30	—31.22	31 64	29.08	23	50	31.63	21	58	29.16
	Oct. 20			37.65	—4.431			61.64	—32.36	.....	29.28	.....			.....		
	Oct. 25			36.03	—4.408			62.45	—32.85	31.63	29.60	.....			.....		
193	Oct. 6	23	53	24.07	—4 535	33	3	43.12	—30.85	19.54	12.27	23	53	19.56	33	3	12.61
	Oct. 15			24.11	—4.523			45 75	—32.54	19.59	12.95	.....			.....		
194	Oct. 9	23	54	37 86	—4.698	44	35	17.53	—31.41	33.16	46.12	.....			.....		
	Oct. 11			37.94	—4.693			19.56	—31.91	33.25	45 81	23	54	33.18	44	34	45.84
	Oct. 20			37.78	—4.656			19.58	—33.98	33.12	45.60	.....			.....		
195	Sept. 18	23	57	5.36	—4.395	16	53	15.93	—28.07	0.97	47.86	.....			.....		
	Oct. 3			5.37	—4.466			20.04	—30.06	0.90	49.98	.....			.....		
	Oct. 10			5.32	—4.473			19.45	—30.84	0.85	48.61	23	57	0.90	16	52	48.49
	Oct. 15			5.36	—4.469			19.19	—31.31	0.89	47.88	.....			.....		
	Oct. 25			5.33	—4 437			20.20	—32.06	0.89	48.14	.....			.....		

A CATALOGUE OF 195 STARS FOR 1880·0.

No.	Constellation.	Mag.	Mean R. A. 1880.			No. of Observations.	Precession.	Mean Dec. 1880.			No. of Observations.	Precession.
			h	m	s		s	°	′	″		″
1	Pegasi	6.0	0	8	43.40	4	+3.09	21	37	2.3	5	+20.04
2	Andromedæ	5.8		14	29.13	3	3.13	32	14	44.0	5	20.01
3	Cassiopeæ	5.8		23	38.66	3	3.30	59	18	50.7	4	19.95
4	Ceti	5.9		23	54.97	1	3.07	— 4	37	15.4	1	19.94
5	Andromedæ	5.9		29	50.64	2	3.15	23	21	50.4	2	19.88
6	Andromedæ	6.0		30	48.33	1	3.15	23	21	17.3	2	19.87
7	Piscium	8.0		47	5.17	1	3.21	26	33		0	19.63
8	k Piscium	5.8		49	31.36	4	3.22	26	33	30.4	4	19.59
9	Cassiopeæ	5.8		49	56.05	1	3.72	65	42	10.2	2	19.56
10	σ Piscium	5.3		56	14.82	2	3.27	31	9	34.7	2	19.44
11	Cassiopeæ	6.0		56	55.41	1	3.66	60	56	10.8	1	19.44
12	D. M. 51°, 220	5.8	0	56	59.58	1	3.49	51	51	32.4	1	19.44
13	Piscium	5.8	1	3	48.93	4	3.24	24	49	18.3	5	19.28
14	D. M. 40°, 289	5.8		20	28.21	3	3.47	40	28	46.1	3	18.83
15	Cassiopeæ	6.0		22	31.86	2	4.11	65	28	39.5	2	18.77
16	Cassiopeæ	......		22		0	4.11	65	27	10.6	1	18.77
17	D. M. 25°, 276	5.8	1	34	36.90	3	3.32	25	8	20.2	4	18.37
18	Arietis	6.0	2	12	11.80	2	3.77	22	36	47.8	3	16.81
19	Persei	......		12	22.05	1	3.55	55	16	21.9	1	16.80
20	i Persei	5.4		13	59.79	2	4.13	55	17	43.6	1	16.72
21	Arietis	5.8		22	23.26	3	3.40	22	55	56.9	5	16.30
22	Persei	6.0		43	39.89	4	3.99	46	20	43.9	5	15.15
23	D. M. 60°, 591	5.8		46		0	4.68	61	1	46.4	2	14.99
24	Cassiopeæ	6.0		57	17.05	1	4.95	63	35	24.6	1	14.34
25	Cassiopeæ	5.4	2	57	55.68	1	6.34	73	56	4.9	1	14.25
26	Persei	5.8	3	6	36.75	2	4.55	56	41	30.7	2	13.77

27	Persei	5.6	3	16	59.52	2	+3.78	33	6	33.4	2	+13.09
28	Tauri	6.0		17		0	3.29	12	12	9.2	1	13.05
29	Persei	5.8		20	48.65	1	3.75	34	10	26.5	1	12.84
30	Tauri[1]	5.6		24	5.15 5.93	1	3.60	27	9	34.9	1	12.62
31	Camelopardalis	6.0		24		0	4.53	54	33	56.6	1	12.58
32	Persei	5 8		25	1.78	1	3.80	35	3	8 1	1	12.55
33	Tauri	6.0		32	2.14	3	3.47	20	31	23.2	3	12.07
34	Camelopardalis	5.2		36	46.20	3	6.14	70	29	49.0	3	11.73
35	Camelopardalis	5.8		54	1.29	2	5.94	68	20	45.4	2	10.48
36	Tauri	5.7		57	53.39	1	3.12	2	29	57.8	1	10.19
37	D. M. 54°, 740	5.8	3	59	54.18	2	4.70	54	30	34.8	2	10.04
38	Cephei	5.1	4	4	8.24	1	12.65	83	2	46.8	1	9.74
39	Tauri	6.0		5	38.47	1	3.43	16	57	59.7	1	9.60
40	Tauri	6.0		13	26.79	1	3.47	18	27	12.8	1	8.99
41	Tauri	6.0		21	17.26	1	3.78	30	5	35.2	1	8.37
42	Tauri	5.8		27	45.52	1	3.19	5	18	55.7	1	7.85
43	Tauri	5.8	4	31	11.11	1	3.53	20	26	31.1	1	+7.58
44	Coronæ Borealis	5.9	15	34		0	2.40	32	4	39.8	1	−11.93
45	Ursæ Minoris	5.8		37	19.65	2	0.14	69	40	15.5	2	11.69
46	Herculis	5.8	15	55	40 17	1	1.70	50	14	25.2	1	10.35
47	Ophiuchi	5.8	16	22	27.10	1	3.05	0	54 56	5.9	2	8.27
48	Herculis	5 9		33	44.16	1	1.88	43	48	14.8	2	7.37
49	Herculis	5 6		39	26.06	2	2.22	34	15	38 9	2	6.91
50	Herculis	6.0		41	25.98	1	1.88	43	26	15.7	2	6.75
51	Herculis	5.9		47	30.71	2	2.58	21	10	28.3	1	6.24
52	Herculis	5 6		49		0	2.58	21	9	11.1	1	6.05
53	Herculis	5.7		55	54.14	1	2.53	22	48	35.7	1	5.54
54	Herculis	5.8	16	59	27.95	3	2.61	19	45	57.7	3	5.25
55	Herculis	5.8	17	1	13.38	2	2.54	22	14	49.0	2	5.09
56	Herculis	4.9		5	40 06	1	1.95	40	55	41.1	2	4.71
57	Draconis	5.8		7	45.71	2	1.37	52	33	21.1	2	4.52
58	Ophiuchi	5.6		10	26.08	2	3.04	1	20	42.7	2	4.30
59	Herculis	5.8		12	45 30	2	2.66	17	26	50.0	2	4.10

[1] Double. R. A. of each component.

A CATALOGUE OF 195 STARS FOR 1880.0—continued.

No.	Constellation.	Mag.	Mean R. A. 1880. h	m	s	No. of Observations.	Precession. s	Mean Dec. 1880. °	′	″	No. of Observations.	Precession. ″
60	Herculis	5.8	17	15	16.29	1	+2.44	25	39	37.1	2	3.89
61	Ophiuchi	5.4		19	8.94	2	2.69	16	24	42.3	2	3.56
62	Draconis	5.8		19	9.55	2	1.29	53	32	5.6	2	3.55
63	Ophiuchi	5.3		24	13.22	2	3.09	−0	57	43.0	3	3.12
64	Herculis	5.3		28	10.06	4	2.61	19	20	39.4	3	2.78
65	Ophiuchi	5.1		28	16.93	1	+2.68	16	24	11.9	1	2.77
66	f Draconis	5.4		32	26.83	2	−0.25	68	12	41.3	2	2.40
67	D. M. 14°, 3321	5.8		37	53.93	1	+2.73	14	21	1.3	2	1.93
68	Draconis	5.8		38	36.54	2	1.38	51	52	36.2	2	1.87
69	Ophiuchi	5.8		38	49.64	1	+2.78	14	27	46.4	1	1.85
70	D. M. 72°, 800	5.8		39	25.19	2	−1.16	72	31	5.5	2	1.80
71	Draconis	5.5		41	28.90	1	+1.25	53	51	9.0	1	1.61
72	Herculis	5.4		41	50.27	1	2.65	17	44	32.3	1	1.59
73	Herculis	6.2		42		0	2.00	38	55	45.1	1	1.58
74	Herculis	6.1		42	0.67	1	1.98	39	22	6.1	1	1.57
75	Herculis	5.6		43	15.79	2	2.57	20	36	19.8	2	1.46
76	Herculis	6.0		45	43.84	1	2.32	29	21	19.2	1	1.25
77	Ophiuchi	5.8		46	30.61	2	3.04	1	20	7.3	2	1.18
78	Herculis	5.7		47		0	2.10	36	8	13.0	1	1.10
79	Ophiuchi	6.0		47		0	2.93	6	7	38.1	1	1.10
80	Herculis	5.3		50	48.34	2	2.52	22	28	59.0	2	0.81
81	Herculis	5.8		54	31.10	2	2.09	36	17	56.9	2	0.48
82	Herculis	5.4		56	12.42	2	2.20	33	13	6.9	2	0.33
83	D. M. 33°, 3009	5.8	17	57	12.28	2	+2.19	33	18	43.5	3	−0.25
84	Herculis	5.8	18	1	16.57	4	2.23	32	13	14.7	4	+0.12
85	Herculis	5.7		3	52.52	3	2.09	36	23	23.4	5	0.34

86	D. M. 3°, 3620	5.8	18	4	40.63	2	+3.00	3	18	4.4	2	+0.41
87	Herculis	6.0		4	47.27	1	2.68	16	27	18.2	2	0.42
88	Ophiuchi	5.8		17	0.47	3	2.79	11	58	17.6	4	1.49
89	Ophiuchi	5.7		19	52.45	2	2.89	7	57	57.2	2	1.74
90	Herculis	5.4		24	28.71	1	2.67	16	54		0	2.14
91	Herculis	5.4		25	44.23	3	2.67	16	50	46.2	3	2.24
92	Lyræ	5.4		28	14.66	4	2.29	30	27	53.5	4	2.47
93	Ophiuchi	5.2		30	44.48	1	2.86	9	1	43.5	1	2.68
94	Ophiuchi	5.5		30	48.90	2	2.92	6	34	41.2	2	2.69
95	e Serpentis	5.6		31	25.77	2	3.08	−0	24	34.8	2	2.74
96	Lyræ	5.7		32	13.18	3	2.20	33	22	7.1	3	2.81
97	Lyræ	5.6		39	21.03	4	2.25	31	48	36.1	4	3.43
98	Lyræ	4.8		41	14.34	2	2.42	26	32	3.8	2	3.58
99	Draconis	6.0		42	29.93	3	1.21	54	46	14.0	3	3.70
100	Lyræ	5.8		43	25.56	2	2.26	31	37	27.1	2	3.78
101	D. M. 24°, 3545	5.8		44	18.65	2	2.46	24	54	39.1	2	3.85
102	Aquilæ	5.7		46	30.89	2	2.75	13	49	21.4	2	4.04
103	Herculis	5.7		50	48.48	2	2.65	17	57	23.1	2	4.41
104	Aquilæ	5.5		52	54.33	3	2.67	17	12	1.5	3	4.59
105	D. M. 19°, 3858	5.6		53	32.07	2	2.61	19	37	54.4	2	4.64
106	Lyræ	5.7		54	52.19	2	2.44	26	3	54.5	2	4.76
107	Draconis	5.6		55	53.70	1	0.28	65	5	49.0	1	4.85
108	D. M. 20°, 4022	5.8		56	12.65	1	2.58	20	39	46.8	1	4.87
109	Draconis	4.9		57	11.20	1	1.51	50	21	49.6	1	4.95
110	Aquilæ	5.8		57	27.86	3	3.04	1	37	46.2	2	4.98
111	D. M. 19°, 3888	5.8	18	57	38.78	2	2.61	19	29	12.3	2	5.00
112	Aquilæ	8.	19	1	5.41	1	2.68	16	42		0	5.28
113	Aquilæ	5.3		2	34.34	3	2.69	16	40	31.6	3	5.33
114	Aquilæ	5.9		5	37.06	1	3.02	2	20	11.7	1	5.66
115	D. M. 82°, 572	5.8		6	47.14	2	−6.28	82	11	42.6	2	5.74
116	Lyræ	6.0		10	45.12	4	+2.33	30	19	3.0	4	6.10
117	Aquilæ	5.6		10	57.08	2	2.75	14	19	58.6	3	6.11
118	Aquilæ	5.8		20	49.50	3	2.79	12	47	0.0	3	6.91
119	Aquilæ	5.8		23	2.69	3	2.76	14	2	26.0	4	7.02
120	Aquilæ	5.8		23	51.38	3	2.75	14	20	59.4	3	7.18
121	D. M. 15°, 3872	5.8		29	59.11	3	2.73	15	20	50.3	3	7.67

A CATALOGUE OF 195 STARS FOR 1880.0—continued.

No.	Constellation.	Mag.	Mean R. A. 1880.			No. of Observations.	Precession.	Mean Dec. 1880.			No. of Observations.	Precession.
			h	m	s		s	°	′	″		″
122	Cephei	5.8	19	30	24.75	1	−7.34	83	13	33.4	2	+7.69
123	Cygni	5.8		31	18.[illegible]7	3	+1.57	5[illegible]	58	46.8	3	7.77
124	Aquilæ	5.7		35	32.23	2	2.78	13	32	17.2	2	8.12
125	Cygni	5.8		38	7.57	2	2.31	32	8	34.9	3	8.32
126	χ Cygni	Var. $\frac{4}{13}$		45	57.25	2	2.81	32	36	41.3	2	8.95
127	Vulpeculæ	5.4		46	58.70	2	2.53	24	41	5.3	3	9.03
128	Cygni	5.6		48	22.14	2	1.81	46	43	7.1	2	9.14
129	Cygni	5.8		48	34.99	3	1.76	47	37	20.9	3	9.12
130	Cygni	5.8		50	25.27	2	2.19	36	40	46.7	2	9.29
131	Cygni	6.7		51	55.10	1	2.37	30	40		0	9.40
132	Cygni	5.7		53	52.54	3	2.38	30	39	31.8	4	9.56
133	Aquilæ	5.9		56	27.40	1	2.86	10	24	23.1	1	9.75
134	Cygni	7.8		57	5.22	1	2.41	29	34		0	9.80
135	Cygni	5.8		58	41.37	3	2.41	29	34	38.0	3	9.93
136	Cygni	5.8		59	53.82	2	2.35	31	52	44.6	3	10.02
137	D. M. 15°, 4040	5.8	19	59	55.24	4	2.76	15	9	30.4	4	10.02
138	Aquilæ	5.8	20	2	54.87	3	2.86	10	22	37.7	3	10.24
139	Cygni	6.0		3	5.84	2	2.30	34	4	30.0	2	10.25
140	D. M. 21″, 4088	5.8		6	6.26	5	2.62	21	31	9.3	5	10.47
141	Sagittæ	5.9		11	6.22	1	2.62	21	56		0	10.85
142	Vulpeculæ	5.5		15	26.81	3	2.51	21	53	53.2	3	11.17
143	Delphini	5.7		17	16.54	2	2.79	14	[illegible]	2.9	2	11.31
144	Cygni	5.5		18	10.35	2	1.95	45	24	36.3	2	11.37
145	Cygni	5.6		19	14.99	2	2.24	37	5	22.4	2	11.45
146	D. M. 63°, 1618	5.7		19	29.12	2	0.96	63	35	42.9	2	11.47
147	Vulpeculæ	5.6		20	22.22	2	2.65	21	1	8.8	2	11.53

148	Vulpeculæ	7.8	20	24	10.76	2	+2.56	25	25			+11.80
149	Vulpeculæ	6.0		26	50.13	5	2.56	25	24	0.3	5	11.98
150	Vulpeculæ	8.0		30	24.09	1	2.66	21	25		0	12.23
151	Vulpeculæ	5.8		33	50.84	4	2.66	21	28	42.1	4	12.47
152	Cygni	5.7		35	51.47	3	2 10	43	2	8.8	3	12.61
153	Cephei	6.0		41	15.06	3	1.56	56	3	8.6	3	12.96
154	Cephei	7.5		42	32.85	1	1.56	56	3		0	13.06
155	Cygni	5.5		43	52.26	3	1.98	47	23	24.3	3	13.15
156	Cygni	6.0		45	5.35	3	1.81	51	27	55.6	3	13.23
157	Delphini	6.0		47	59.02	3	2.76	17	34	35.2	3	13.35
158	Cygni	6.0		49	2.27	2	2.43	32	58	55.5	2	13.48
159	Cygni	8.0		51	11.54	1	2.23	40	43		0	13.62
160	Delphini	5.7	20	54	58.61	4	2.74	18	51	48.7	4	13.87
161	149 Cygni	5.6	21	1	28.11	4	2.51	30	42	13.3	4	14.27
162	D. M. 53°, 2588	5.6		13	16.73	5	1.88	53	29	37.0	5	14.98
163	Pegasi	5.8		14	46.93	4	2.72	21	31	6.9	4	15.07
164	Cygni	5.8		16	18.74	3	2.52	32	6	12.2	3	15.15
165	Cygni	5.4		22	36.02	5	2.12	48	18	48.3	5	15.51
166	Pegasi	5.6		23	30.76	2	2.74	21	39	19.7	2	15.56
167	Pegasi	5.8		25	21.39	5	2.90	11	36	39.5	5	15.66
168	Cygni	6.0		28	42.10	3	2.11	49	26	43.9	3	15.84
169	Pegasi	5.5		47	58.57	5	2.83	19	6	10.8	5	16.82
170	D. M. 20°, 5046	5.6		50	47.36	6	2.80	20	40	11.5	6	16.95
171	Lacertæ	5.8	21	58	6.20	6	2.41	44	4	18.1	6	17.29
172	Pegasi	6.0	22	4	44.14	6	2.95	11	2	12.1	6	17.57
173	Cephei	5.7		7	54.39	6	1.39	69	32	24.6	5	17.70
174	Lacertæ	5.8		22	11.04	5	2.62	39	11	55.9	5	18.25
175	Cephei	5.6		22	54.72	4	1.55	70	9	35.7	4	18.27
176	Pegasi	5.5		23	32.88	4	2.80	26	9	0.1	4	18.30
177	Lacertæ	5.8		34	8.69	6	2.70	36	58	5.4	5	18.66
178	Lacertæ	6.7		34	47.36	1	2.70	36	54	10.2	1	18.68
179	Lacertæ	5.7		49	27.85	5	2.77	36	26	14.8	5	19.11
180	Lacertæ	5.8		50	9.19	4	2.78	35	42	41.4	4	19.13
181	Lacertæ	7.0		51	59.95	1	2.78	35	43	49.8	1	19.13
182	D. M. 51°, 3514	5.8		53	58.66	3	2.59	52	0	38.6	3	19.23
183	D. M. 30°, 4859	5.8		54	59.06	6	2.85	30	26	20.6	6	19.25

A CATALOGUE OF 195 STARS FOR 1880.0 — concluded.

No.	Constellation.	Mag.	Mean R. A. 1800. h	m	s	No. of Observations.	Precession. s	Mean Dec. 1880. °	′	″	No. of Observations.	Precession. ″
184	D. M. 56°, 2923	5.8	22	55	1.90	3	+2.51	56	18	6.4	3	+19.25
185	D. M. 22°, 4762	5.8		56	29.92	2	2.92	22	41	41.4	2	19.29
186	Pegasi	6.0	23	25	32.96	6	2.96	28	0	16.5	6	19.82
187	Pegasi	5.8		27	54.36	6	3.00	20	10	43.7	6	19.85
188	Andromedæ	6.0		34	41.01	7	2.96	36	3	18.9	7	19.93
189	Cassiopeæ	6.0		41	10.29	4	2.90	56	47	6.2	4	19.98
190	Andromedæ	5.7		43	39.04	6	3.00	35	45	35.4	6	20.00
191	D. M. 46°, 4214	5.7		49	30.38	5	3.00	46	41	18.6	5	20.03
192	Pegasi	5.8		50	34.68	3	3.05	21	58	49.2	4	20.04
193	Andromedæ	5.7		53	22.61	2	3.05	33	3	32.6	2	20.04
194	D. M. 44°, 4538	5.8		54	36.21	3	3.03	44	35	5.9	3	20.05
195	D. M. 16°, 5034	5.8	23	57	3.97	5	+3.07	16	53	8.5	5	20.05

III. REDUCTION TABLES FOR THE LATITUDE OF MADISON,

Computed under the direction of Prof. JAMES C. WATSON *by* Mr. G. C. COMSTOCK *of the Washburn Observatory, and by* Mr. J. M. SCHAEBERLE *of the Detroit Observatory of Ann Arbor.*

These tables were prepared during the years 1879, '80 and '81, chiefly under the direction of Professor WATSON. Table VII., with its auxiliary tables, A, B, C, D, was computed by Mr. SCHAEBERLE. Tables XII. and XIII. were prepared by Professor HOLDEN. All the others have been computed by Mr. COMSTOCK, aided in some cases by duplicate computations by Mr. E. W. DAVIS, a student in the Observatory. A list of these tables follows:

Table I: Table of Diurnal Aberration in Right Ascension.

Table II: Table of Transit Factors for the Washburn Observatory. It gives, with the declination as argument, the values of the factors:

$$A=\sin(\varphi-\delta)\sec\delta,$$
$$B=\cos(\varphi-\delta)\sec\delta,$$
$$C=\sec\delta,$$
$$D=\tan\delta.$$

The interval of the argument is 10′ and the table extends from —42° 40′ to +80° 0′.

Table III: This table gives the transit factors A, B, C, D, for all those stars of the *American Ephemeris* for 1879 and of the Berlin list of 539 stars, which lie between —40° and +70°.

Table IV: Contains the transit factors A, B, C, D, for all the stars of the two lists named above which lie between +70° and +80°.

Table V: Contains transit factors A, B, C, D, for all the stars of the two lists named above which lie north of +80°.

Table VI: This is a table for computing refractions of stars observed out of the meridian.

Table VII: This is a table of differential refraction in Right Ascension and Declination.

It is followed by a table (VII A), which gives the zenith distances of stars of different declinations, with the argument hour-angle.

Table VIII: This is a general parallax-table and it is followed by

Table IX: A table of the parallax in Declination and Right Ascension.

Table X: Is a table of semi-diurnal arcs, and gives, with the declination as argument, the hour angle of a star in the horizon, assuming the horizontal refraction to be 34′.

Table XI: Is a table of the sun's motion in Right Ascension and Declination between the meridians of Greenwich or Washington and Madison.

Table XII: Is a table of the intervals of the wires of the FAUTH Transit Instrument, for all declinations between the equator and 57.°

Table XIII: Is a table giving the approximate local mean time of Sunrise and Sunset for every tenth day of the year at Madison.

The foregoing very complete tables would require about 120 printed pages. The manuscript tables were given to the state printer in 1881, but owing to the pressure of the public business, a delay of six months has occurred and the tables are not yet reached.

I have therefore reluctantly concluded to postpone the printing of these tables until such a time as they will be required for use, in order that the present volume may be issued within a reasonable time of the date which it bears (September 30, 1881). This course is the more satisfactory, as the chief use of the tables in question is in the reduction of regular meridian observations, which, in any case, can hardly be commenced before 1883.

IV. LIST OF NEW NEBULÆ AND CLUSTERS DISCOVERED IN THE ZONE OBSERVATIONS AT THE WASHBURN OBSERVATORY, FROM APRIL 23 TO SEPTEMBER 30, 1881.

The following nebulæ have been discovered in the zone observations made with the 15½ inch CLARK equatorial since April 23.

The eyepiece employed was specially made for this work by KAHLER, of Washington. It has a field of 25′.5 and magnifies 145 diameters. A pair of wires is placed in its focus, and also a mica scale divided to single minutes. This eyepiece is mounted on a slide, so that it can be pushed to one side and a second eyepiece of higher power can be placed in focus in about one second of time. This process is sometimes necessary in examining ambiguous objects. Since May 3, 1881, most of the zone observations have been made by myself; before that time some were made by Mr. BURNHAM. They have not been continuous, as it was desired to prosecute the work of observing a certain class of double stars selected from Mr. BURNHAM'S MS. catalogue, during his (temporary) connection with this Observatory. They will be resumed in the future.

The method of observation was by sweeps in declination in or near the meridian. The places are for 1860.0.

No. 1.

1882 April 10: 10h 11m 51s; 107° 17′; p. B. E. 160°. N.
April 11: ....; .... ; as before.

No. 2.

1882 April 6: 10h 45m 13s; 82° 3′; Neb. no description. (Hazy.)
April 7: ....; ......; Neb. no description. (Hazy.)
April 10: ....; ......; Neb. p. B.

No. 3.

1881 April 27: 11h 0m 24s; 82° 34′; Neb. f. D. M. 2413, 46.5s.
1882 April 20: 11h 0m 21s; 82° 31′; Neb. is elong. 50° ± and at its s. p. end is a star 11m. This star f. 2413 43s.5.

This may be MARTH 215 (G. C. 5546). If so MARTH's position appears to be wrong.

No. 4.

1881 April 27: 11h 32m ..s; 84° 15′; v. F.
April 28: 11h 32m 36s; 84° 12′; v. F. diffused. Neb. makes an isosceles triangle with D. M. 2523 and 2525.

No. 5.

1881 April 27: 11h 36m 44s; 81° 17′; F.
April 28: ....; ......; F. elong. 225°; follows a star 11 mag. 14s.

No. 6.

1881 April 23: 11h 49m ..s; 91° 55′; p. F.
April 27: 11h 48m 50s; 91° 55′; the Neb. p. D. M. 2593, 42s. A star 11.5 n. and f. 30″.

No. 7.

1881 April 27: 12h 30m ..s; 84° 51′; F. n. p. a star 7 mag.
1882 April 20: 12h 30m 23s; 84° 52′; p. G. C. 3125, 55.5s and 3′ north.

No. 8.

1881 April 23: ....; 89° 45′; B. m. E. 90°.
1882 May 8: 12h 32m 4s; 89° 46′; p. B. b. M. E. 100°. Neb. p. D. M. 2967, 46.5s.

G. C. 3130 is 12h 32m 8s; 89° 16′. The sky became cloudy before this could be found May 8.

No. 9.

1881 May 17: 13h 2m 25s; 105° 46′; S. R. stellar N. follows B. A. C. 4396 8s in p=90°.

This nebula was first discovered by S. W. BURNHAM at the Dearborn Observatory, 1878, March 28.

No. 10.

1881 May 17: 13h 6m 28s; 105° 45′; v. F. S. G. C. 3465 follows 1m 28s.

No. 11.

1881 May 17: 13h 6m 37s; 105° 23′; v. F. like a neb. star 10—11 mag. G. C. 3465 follows 2m.

No. 12.

1881 May 17: 13h 7m 22s; 105° 46′; F. S. R. N. G. C. 3465 follows 34s.

No. 13.

1881 May 28: 13h 7m 36s; 105° 12′; p. B. extended.
May 29: ....; ....; c. B. E 90° ∓ stellar. follows Ll. 24460 4m 28s and is 3′ north.

No. 14.

1881 May 17: 13h 8m 17s; 105° 35′; F. v. S. R. stellar N. G. C. 3465 precedes 21s.

No. 15.

1881 April 27: 13h 12m 17s; 80° 50′; F. S. in field with Ll. 24735.
April 28: 13h 12m 18s; 80° 51′; s. p. Ll. 24735, (7 mag.) 38s.

No. 16.

1881 April 23: 14h 4m ..s; 90° 30′; E. 180°; b. M. 6′–8′ long.
1882 May 8: 14h 4m 24s; 90° 29′; as before; p. B.
Neb. follows D. M. 2787 3m 27.5s and is 6.5′ south.

No. 17.

1881 April 27: 14h 45m ..s; 81° 27′; F.
April 28: 14h 45m 47s; 81° 27′; v. F. exactly north of Ll. 27090.

No. 18.

1881 May 6: 17h 40m ..s; 122° 44′; Cl. 15′ large. Coarse cluster of 30–40 stars; several 8 mag.

No. 19.

1881 May 2: 18h 8m ..s; 108° 20′; This is a black circular hole in the Milky Way (10′ ± in diameter). The stars about it are excessively crowded, and inside there are but two stars; one tolerably bright 10 mag., and the other very small.

No. 20.

1881 May 20: 18h 17m ..s; 110° 0′; Coarse cluster detached from the Milky Way. It contains a reddish star.

No. 21.

1881 August 14: 20h 18m 50s; 109° 4′; v. F. 8 mag. star follows Neb. 16s.
September 17: .... ; ...... ; v. F. Neb. p. o *Capricorni* 182s.
There is a pair of stars 14–15 mag. a few seconds n. p. the Nebula.

No. 22.

1881 June 20: 22h 5 m 28s; 35° 17′; p. B. Neb. connected with a small Cl. of stars which radiate in two streams from f. to p. side. Diam. of Neb. 5′, of Cl. 15′, n. p. in p=315° is a small knot which may be nebulous.
July 17: .... ; ...... ; as before.

No. 23.

1881 June 21: 23h 0m 39s; 58° 25′; v. F. D. M. 4850 (9.4 mag.) is 30s.6 f and 1′ north of the neb.
June 24: .... ; ...... ; F.

In finding the above Nebulæ the following of HERSCHEL'S General Catalogue have been found and identified, viz.: Numbers
526; 2301; 2542; 2663; 2674; 2607; 2703; 2829; (2829); 2878; 2884; 2979; 2991; 3018; 3020; 3021; 3040; 3082; 3125; 3198; 3273; 3280; 3332; 3337; 3338; 3366; 3383; 3418; 3461; 3465; 3468; 3469; 3473; 3696=3698; 3721; 3748; 3777; 3791; 3864; 3866; 3868; 3889; 3954; 3990; 4093; 4094; 4142; 4180; 4193; 4287; 4340; 4346; 4358; 4382; 4389; 4397; 4414; 4428; 4514; 4632; 4776; 4778; 4964; 4993; 5005; 5546; 5734; 5746; 5751; 5772; 5942; 5966; 6009; 6094.

On these the following notes may be given:

No. 2542 v. F. E. 80°; *Not* v. S.
2607 p. F. diff. l. b. M. ex. 90.°
2878 b. M. visible in finder.
2829 b. M. *not* v. F. 8.′ n. of a star 8^{m}.
2884 F. 10′ n. p. *not* n. f. 2878; near a star 9^{m}.
2979 F. in the field with 3 stars 9^{m}.
3018 F.
3020 F.
3021 v. B. visible in finder.
3040 F. near 2 stars 10^{m}.
3082 elong. 160°; star 11^{m} follows 10″.
3332 star 10^{m} 20″ n. f.
3461 p. B. elong. 220° m. b. M. N.
3468 F.
3469 e. F. S. R. stellar N.
3473 W. HERSCHEL called this p. B. p. L. i. fig. m. b. M.; J. HERSCHEL called it, F. p. S. i. R.; I find it B. i. fig. stell. N.
3868 F. n. p. a star 9^{m}.
5546 v. F. E. 225°; star 12^{m} p = 225°, s = 20′.
5751 seems p. B. 1881, April 28.
5966 not *very* F.

V. LIST OF 60 NEW DOUBLE STARS DISCOVERED IN THE ZONE OBSERVATIONS AT THE WASHBURN OBSERVATORY FROM APRIL 23 TO SEPTEMBER 30, 1881.

The following double stars have all been found in the zone observations with the KAHLER eyepiece, previously described (field =25'.5, power =145), mostly by myself. The measures have all been made by Mr. S. W. BURNHAM with the micrometer.

The micrometer eyepieces available during this period were:

I. Magnifying power 195 diameters; field=11'.6.
II. Magnifying power 260 diameters; field= 8'.6.
III. Magnifying power 430 diameters; field= 5'.6.
IV. Magnifying power 750 diameters; field= 3.'6.

The positions are for 1880.0.

No. 1. D. M. (53°) 25.

R. A. 0h 8m 15s.
Decl. +53° 10'.

	°	"			
1881.556	....	2.68	8.4..11.0	I	20:00
.559	11.7	2.93	8.5..10.8	I	19:15
.575	15.0	2.21	8.3..11.0	I	19:45
1881.56	13.3	2.61	8.4..10.9		

No. 2. O. Arg. 323.

R. A. 0h 18m 51s.
Decl. +50° 54'.

	°	"			
1881.575	332.5	2.14	9.3..9 3	I	20:20
.578	334.0	2.71	8.5..8.5	II	21:05
.581	329.7	2.47	8 7..8.7	I	21:20
1881.58	332.1	2.44	8.8..8 8		

No. 3. D. M. (52°) 158.

R. A. 0h 38m 24s.
Decl. +52° 54'.

	°	"			
1881.545	54.5	2.59	8.7..8.8	I	20:30
.556	....	2.88	8.4..8.4	I	20:30
.559	53.9	2.61	8.5..8.6	I	19:30
.608	55.1	2.54	8.5..8.6	II	20:45
1881.57	54.5	2.65	8.5..8.6		

No. 4. D. M. (53°) 184.

R. A. 0h 50m 34s.
Decl. +53° 45′.

	°	″			
1881.575	124.2	0.89	8.6..8.9	II	20:30
.578	126.4	1.05	8.5..9.0	II	21:35
.589	124.4	0.96	8.5..9.0	II	21:45
1881.58	125.0	0.97	8.5..9.0		

No. 5. D. M. (27°) 167.

R. A. 0h 57m 31s.
Decl. +27° 8′.

	°	″			
1881.641	175.2	2.85	8.5..11.0	I	21:20
.668	180.2	3.08	8.6..11.5	I	20:55
.709	181.7	3.03	8.7..12.0	I	22:10
1881.67	179.0	2.99	8.6..11.5		

No. 6. W_2 B. 612.

R. A. 1h 29m 6s.
Decl. +22° 26′.

	°	″			
1881.575	109.4	2.15	9.5..9.5	II	21:25
.581	108.6	2.14	9.0..9.0	I	21:30
.586	107.0	2.12	8.7..8.7	II	21:00
1881.58	108.3	2.14	9.1..9.1		

No. 7. Ll. 4370.

R. A. 2h 16m 45s.
Decl. +57° 40′

	°	″			
1881.545	184.7	1.52	8.0.. 9.5	II	20:50
.556	.....	1.90	8.3..10.8	II	21:00
.578	188.3	1.96	8.0..10.8	II	21:45
1881.56	186.5	1.79	8.1..10.4		

No. 8. D. M. (49°) 950.

R. A. 3h 21m 57s.
Decl. +49° 22′.

	°	″			
1881.589	174.3	1.91	8.4..8.7	I	22:25
.608	178.5	1.70	8.5..8.8	I	22:10
.616	176.7	2.10	8.4..8.8	II	20:35
1881.60	176.7	1.90	8.4..8.8		

No. 9. O. Arg. 3946.

R. A. 3h 29m 11s.
Decl. +47° 43′.

	°	″			
1881.589	61.3	1.28	8.5..8.6	I	22.35
.608	62.9	1.29	8.5..8.6	I	22.15
.616	64.3	1.42	8.4..8.4	II	21.55
1881.60	62.8	1.33	8.5..8.5		

No. 10. O. Arg. 4360.

R. A. 3h 53m 22s.
Decl. +47° 52′.

	°	″			
1881.589	88.9	4.42	8.5.. 9.5	I	22:45
.608	89.8	4.36	8.4.. 9.7	I	22:20
.616	89.8	4.47	8.6..10.8	I	22:10
1881.60	89.5	4.42	8.5..10.0		

No. 11. Anon.

R. A. 10h 36m 15s.
Decl. − 2° 15′.

	°	″			
1881.329	86.8	3.75	8.7..9.5	I	11:00

No. 12. D. M. (— 1°) 2656.

R. A. 12h 15m 43s.
Decl. — 1° 57′.

	°	″			
1881.329	93.2	1.24	8.0..8.5	II	12:00
.331	89.6	1.13	8.3..9.0	II	12:15
.334	97.0	1.02	8.5..8.8	II	11:20
1881.33	93.3	1.13	8.3..8.8		

No. 13. D. M. (— 1°) 2666.

R. A. 12h 20m 17s.
Decl. — 1° 13′.

	°	″			
1881.329	154.4	1.55	8.0..8.5	II	12:05
.331	151.8	1.28	8.0..8.3	II	12:25
.334	153.3	1.36	8.2..8.3	II	11:25
1881.33	153.2	1.40	8.1..8.4		

No. 14. Lamont 1121.

R. A. 12h 54m 39s.
Decl. + 3° 31′.

	°	″			
1881.419	264.1	2.71	8.3..10.5	I	14:10
.447	260.4	2.92	8.3..10.5	I	14:15
1881.43	262.2	2.81	8.3..10.5		

No. 15. Ll. 25043.

R. A. 13h 26m 46s.
Decl. — 1° 48′.

	°	″			
1881.309	295.1	16.14	7.0..11.0	III	13:50
.331	297.4	16.20	7.0..11.5	II	13:00
1881.32	296.3	16.17	7.0..11.2		

No. 16. Ll. 25923.

R. A. 14h 2m 9s.
Decl. — 2° 58′.

	°	″			
1881.433	219.7	3.07	8.3..8.5	II	15:45
.438	216.2	3.19	8.5..8.6	I	14:15
.447	219.1	3.02	8.5..8.6	I	14:25
1881.44	218.3	3.09	8.4..8.6		

No. 17. Anon.

R. A. 14h 4m 16s.
Decl. — 2° 6′.

	°	″			
1881.329	243.7	4.28	8.8. 9.5	I	14:10
.331	244.3	4.15	9.0..9.7	I	13 :15
.447	242.7	4.55	8.7..9.2	I	14:50
1881.37	243.6	4.33	8.8..9.5		

No. 18. Ll. 26172.

R A. 14h 12m 48s.
Decl. — 17° 58′.

	°	″			
1881.370	359.0	3.66	7.8..11.0	II	14:40
.380	358.7	3.52	7.5 11.0	II	14:40
.386	356.0	3.56	7.5..11.0	II	13:30
1881.38	357.9	3.58	7.6..11.0		

No. 19. Anon.

R. A. 14h 36m 50s.
Decl. —24° 44′.

	°	″			
1881.389	194.6	1.69	9.3..11.0	I	14:10
.397	195.2	1.83	9.5..11.0	I	14:20
1881.39	194.9	1.76	9.4..11.0		

No. 20. 5 Libræ.

R. A. 14h 39m 21s.
Decl. —14° 57′.

	°	″			
1881.419	250.4	2.86	6.5..11.0	II	14:20
.438	249.6	2.47	6.0..11.0	I	15:00
.447	249.4	2.75	6.3..10.8	II	14:40
1881.43	249.8	2.69	6.3..11.0		

No. 21. Anon.

R. A. 14h 48m 57s.
Decl. —14° 15′.

	°	″			
1881.419	22.3	3.92	8.5..8.6	II	14:30
.438	23.0	3.95	8.8..8.8	I	15:15
.447	23.6	3.90	8.3..8.3	I	14:30
1881.43	23.0	3.92	8.5..8.6		

No. 22. Anon.

R. A. 14h 55m 19s.
Decl. —19° 48′.

	°	″			
1881.389	360.8	2.28	8.3..9.5	I	14:00
.395	360.8	2.14	8.5..9.5	I	16:30
.397	358.6	2.23	8.6..9.0	I	15:30
1881.39	360.1	2.22	8.5..9.3		

No. 23. Anon.

R. A. 15h 2m 51s.
Decl. —7° 48′.

	°	″			
1881.383	360.1	3.44	8.7..9.0	I	17:20
.389	361.4	3.30	8.5..8.8	I	14:55
.395	360.5	3.46	8.7..8.8	I	16:15
1881.39	360.7	3.40	8.6..8.9		

No. 24. Anon.

R. A. 15h 16m 5s.
Decl. —25° 30′.

	°	″			
1881.389	276.7	3.56	8.7..9.0	I	15:00
.419	276.0	3.94	8.5..8.7	I	15:35
.433	276.9	3.79	8.7..8.8	I	15:15
1881.41	276.5	3.76	8.6..8.8		

No. 25. Anon.

R. A. 15h 33m 35s.
Decl. —14° 8′.

	°	″			
1881.395	312.8	1.32	8.8..9.3	I	16:35
.397	316.2	1.16	9.0..9.1	I	15:50
.433	312.5	1.24	8.6..8.8	II	15:35
1881.41	313.8	1.24	8.8..9.1		

No. 26. Anon.

R. A. 16h 31m 10s.
Decl. —5° 6′.

	°	″			
1881.389	4.3	7.06	9.0..9.5	I	15:25
.395	3.9	7.00	8.7..8.7	I	17:25
.433	4.1	6.92	8.8..8.8	I	16:15
1881.41	4.1	6.99	8.8..9.0		

No. 27. Ll. 30853.

R. A. 16h 52m 32s.
Decl. —13° 1′.

	°	″			
1881.419	136.6	4.78	8.5..9.3	I	15:50
.436	133.3	4.85	8.5..8.8	I	16:05
.447	135.0	4.99	8.5..9.3	I	16:35
1881.43	135.0	4.87	8.5..9.1		

No. 28. O. Arg. 16709.

R. A. 17h 16m 46s.
Decl. —30° 25′.

	°	″			
1881.507	238.1	3.73	8.9..9.5	I	18:40
.578	236.5	3.52	8.6..8.8	I	18:30
.616	235.8	3.00	8.5..9.0	I	18:05
1881.57	236.8	3.42	8.7..9.1		

No. 29. O. Arg. 16893.

R. A. 17h 24m 35s.
Decl. — 30° 22′.

	°	″			
1881.433	230.6	1.44	7.8..8.3	II	17:05
.436	229.4	1.38	8.0..8.5	I	17:05
.496	230.6	1.24	8.0..8.7	II	16:55
1881.45	230.2	1.35	7.9..8.5		

No. 30. Ll. 32046.

R. A. 17h 30m 29s.
Decl. — 23° 19′.

	°	″			
1881.419	111.1	3 42	8.3..9.0	I	16:05
.433	111.9	3.32	8.0..9.0	I	17:55
.436	112.1	3.10	8.5..9.5	I	17:15
1881.43	111.7	3.28	8.3..9.2		

No. 31. Anon.

R. A. 17h 31m 44s.
Decl. —14° 46′.

	°	″			
1881.383	334.7	1.33	9.0..9.3	I	18:00
.395	341.8	1.42	8.8..9.0	I	17:40
1881.38	338.2	1.38	8.9..9.2		

No. 32. Anon.

R. A. 17h 55m 15s.
Decl. —27° 4′.

	°	″			
1881.433	101.5	4.68	8.0..8.8	I	18:00
.436	102.1	4.54	8.0..8.8	I	17:25
.447	100.8	4.41	8.0..8.7	I	18:10
1881.44	101.5	4.54	8.0..8.8		

No. 33. Anon.

R. A. 18h 55m 40s.
Decl. —28° 49′.

	°	″			
1881.496	59.2	2.54	8.3..8.4	II	18:00
.507	60.4	1.90	8.2..8.4	II	19:20
.581	57.6	2.82	8.5..8.5	I	20:10
1881.53	59.1	2.42	8.3..8.4		

No. 34. Radcliffe 4234.

R. A. 19h 9m 55s.
Decl. +55° 6′

	°	″			
1881.460	271.5	3.14	8.5..9.2	III	14:45
.465	271.7	3.26	8.4..9.0	II	14:50
.471	270.3	3.49	8.5..9.0	I	15:35
1881.46	271.2	3.30	8.5..9.1		

No. 35. Anon.

R. A. 19h 17m 1s.
Decl. —18° 43′.

	°	″			
1781.638	191.7	1.40	8.5..8 9	II	19:10
.641	193.0	1.57	9.0..9.2	III	19:00
.666	188.9	1.22	8.8..9.0	II	19:25
1881.65	191.2	1.40	8.8..9.0		

No. 36. Anon.

R. A. 19h 49m 45s.
Decl. — 20° 48′.

	°	″			
1881.692	215.9	0.93	8.5..9.0	III	19:30
.698	214.0	1.03	8.5..9.0	I	19:40
.731	212.9	1.14	8.5..9.0	II	19:40
1881.71	214.3	1.03	8.5..9.0		

No 37. Anon.

R. A. 20h 2m 12s.
Decl. —4° 1′.

	°	″			
1881.644	314.5	2.97	8.6..11.0	I	19:20
.668	313.6	3.17	8.6..11.5	I	19:20
.692	312.8	3.03	8.7..11.8	I	19:00
1881. 67	313.6	3.06	8.6..11.4		

No. 38. Schj. 8070.

R. A. 20h 22m 48s.
Decl. —8° 25′.

	°	″			
1881.692	298.6	2.76	8.5..11.0	I	19:10
.698	298.7	2.76	8.6..11.5	I	19:20
.709	296.2	2.47	8.4..11.0	I	20:50
1881. 69	297.8	2.66	8.5..11.2		

No. 39. D. M. (50°) 3145.

R. A. 20h 33m 7s.
Decl. +50° 28′.

	°	″			
1881.460	176.2	7.67	8.0..11.0	II	15:00
.465	177.2	7.79	8.0..11.0	I	15:00
.471	175.5	7.46	8.0..10.5	I	.....
1881. 46	176.3	7.64	8.0..10.8		

No. 40. O. Arg. 20773.

R. A. 20h 36m 34s.
Decl. —19° 55′.

A and B.

	°	″			
1881.496	358.2	5.30	8.7..9.0	I	18.50
.506	357.6	5.37	8.5..8.8	I	19.40
1881.50	357.9	5.33	8.6..8.9		

C and D.

	°	″			
1881.496	187.4	4.63	9.0.. 9.5	I	19.40
.507	187.3	4.71	9.2..10.5	I	19.40
1881.50	187.3	4.67	9.1..10.0		

A and C.

	°	″			
1881.496	257.7	144.76	....	I	18.55
.507	257.7	144.66	....	I	19.45
1871.50	257.7	144.71	....		

No. 41. O. Arg. 20773.

R. A. 20h 42m 5s.
Decl. +53° 35′.

A and B.

	°	″			
1881.460	238.4	3.37	8.5..12.5	I	16.10
.490	237.0	3.43	8.5..12.0	I	16.50
1881.47	237.7	3.40	8.5 .12.3	I	16.50

A and C.

	°	″			
1881.460	261.6	7.84	.....11.0	I	15.15
.465	263.5	8.06	8.2..11.0	I	15.20
471	263.3	7.78	8.5..11.0	I	16.00
1881.47	262.8	7.89	8.4..11.0		

No. 42. Anon.

R. A. 20h 46m 32s.
Decl. — 17° 44°.

	°	″			
1881.698	228.4	1.03	8.6..9.0	II	19.55
.709	229.2	0.90	8.7..8.7	II	20.40
.731	227.1	1.03	8.8..9.0	II	20.50
1881.71	228.2	0.99	8.7..8.9		

No. 43. D. M. (2°) 4262.

R. A. 20h 46m 48s.
Decl. +2° 45′.

	°	″			
1881.638	4.5	1.96	8.4..10.0	II	20:15
.641	2.4	2.09	8.5..10.8	I	20:20
.644	4.1	1.69	8.4..10.8	I	19:40
1881.64	3.7	1.91	8.4..10.5		

No. 44. O. Arg. 22177.

R. A. 21h 19m 25s.
Decl. +50° 1′.

	°	″			
1881.460	272.2	2.73	8.5..10.5	I	15:40
.465	270.7	2.88	8.5..10.8	I	15:50
4.90	273.9	2.52	8.2..10.0	I	17:00
1881.47	272.3	2.71	8.4..10.4		

No. 45. W_2 B. XXI. 591.

R. A. 21h 25m 21s.
Decl. +34° 32′.

	°	″			
1881.493	16.0	1.23	8.7..9.5	III	19:40
.499	19.3	1.27	8.3..8.8	II	19:20
.504	18.1	1.35	8.5..9.0	II	16:20
1881.49	17.8	1.28	8.5..9.1		

No. 46. D. M. (35°) 4585.

R. A. 21h 31m 39s.
Decl. +35° 52′.

	°	″			
1881.504	197.3	1.16	9.5..9.8	II	16:50
.556	..	1.20	9.5..9.8	II	19:15
.559	203.6	1.18	9.6..9.8	I	18:15
1881.54	200.4	1.18	9.5..9.8		

No. 47. D. M. (49°) 3578.

R. A. 21h 34m 9s.
Decl. +49° 23′.

	°	″			
1881.490	229.0	6.84	8.5..12.0	I	17:50
.493	228.6	6.25	8.6..12.0	I	19:50
.499	229.1	6.81	8.0..12.0	I	17:10
1881.49	228.9	6.63	8.4..12.0		

No. 48. O. Arg. 22899.

R. A. 21h 44m 18s.
Decl. +51° 3′.

	°	″			
1881.460	22.0	4.50	8.7..9.0	I	16:25
.465	23.2	4.19	8.3..8.8	I	16;00
.490	23.4	4.62	8.7..9.0	I	17:30
1881.47	22.9	4.44	8.6..8.9		

No. 49. D. M. (28°) 4212.

R. A. 21h 46m 22s.
Decl. +28° 22′.

	°	″			
1881.499	343.6	2.18	8.5..10.7	II	19:20
.504	346.0	2.22	8.2..10.5	I	17:10
.556	.....	2.21	8.5..10.5	II	19:25
.559	344.9	2.29	8.7..10.5	I	18:20
1881. 53	344.8	2.23	8.5..10.5		

No. 50. O. Arg. 22967.

R. A. 21h 47m 14s.
Decl. +53° 44′.

	°	″			
1781.460	171.9	1.25	8.8..10.5	II	16:15
.465	172.7	1.42	8.7..10.0	I	16:05
.493	166.8	1.75	8.7..10.8	I	20:10
.578	174.9	1.44	8.4..10.5	I	20:15
1884. 50	171.5	1.47	8.7..10.4		

No. 51. D. M. (+1°) 4630.

R. A. 22h 29m 5s.
Decl. +2° 3′.

	°	″			
1881.622	179.0	0.90	8.5.. 9.0	I	19:40
.638	181.8	0.90	8.3.. 8.8	II	20:50
.641	182.5	0.91	8.6.. 9.0	II	20:50
1881. 63	181.1	0.90	8.5.. 8.9		

No. 52. O. Arg. 24396.

R. A. 22h 32m 18s,
Decl. +50° 40′.

	°	″			
1881.490	290.5	...	....	I	18:00
.493	286.2	4.56	8.3..12.0	I	20:35
.490	291.7	4.56	8.3..11.0	I	17:30
.529	288.6	4.74	8.0..10.5	I	21:05
.531	290 8	5.18	8.0..11.0	I	18:55
.540	286.5	4.85	8.0..11.0	I	17:50
.542	291.1	4.54	8.0..11.0	I	20:15
1881.52	289.3	4.75	8.1..11.1		

No. 53. Lamont 4660.

R. A. 22h 42m 54s.
Decl. —7° 8′.

	°	″			
1881 638	4.7	1.58	8.6.. 9.5	II	20:00
.698	0.0	1.44	8.6: 10.0	II	20;20
.709	2.2	1.49	8.6..10.5	II	21:00
1881.68	2.3	1.51	8.6..10.0		

No, 54. O. Arg. 24750.

R. A. 22h 45m 33s.
Deci. +50° 29′.

	°	″			
1881.545	196.6	1.80	9.0..9.3	II	19:50
.556	.....	1.90	8.4..8.5	I	20:10
.559	195.2	1.57	8.6..8.8	I	18:10
1881.55	195.9	1.76	8.7..8.9		

No. 55. W_2 B. XXII. 1210.

R A. 22h 53m 55s.
Decl. +39° 38′.

	°	″			
1881.575	192.6	1.84	9.0..10.3	II	18:05
.578	191.8	1.94	9.3..10.0	II	20:30
.518	190.6	1.69	9.0..10.0	I	21:10
1881.58	191.7	1.82	9.1..10.1		

No. 56. D. M. (41°) 4656.

R. A. 22h 54m 11s.
Decl. +41° 11′.

	°	″			
1861.414	122.5	1.10	8.0..8.5	II	19:00
.419	122.4	1.00	8.5..8.5	II	19:15
.447	129.6	0.86	8.5..8.5	II	18:20
.449	126.2	0.74	8.5..8.6	II	18:10
1881.48	125.2	0.93	8.4..8.5		

No. 57. D. M. (50°) 3962.

R. A. 23h 3m 49s.
Decl. +50° 53′.

	°	″			
1881.493	293.1	2.59	8.5..10.7	I	20:45
.504	295.6	2.46	8.5.. 9.5	I	18:25
.545	298.2	2.34	9.0..10.8	I	20:15
1881.51[illegible]	295.8	2.46	8.7..10.3		

No. 58. O. Arg. 25809.

R. A. 23h 30m 53s.
Decl. +53° 17′.

	°	″			
1881.545	0.4	3.89	8.8..11.0	I	20:20
.556	...	3.63	8.4..10.5	I	20:10
.559	1.6	3.59	8.5..11.0	I	18:30
1881.55	1.0	3.70	8.6..10.8		

No. 59. O. Arg. 26248.

R. A. 23h 53m 57s.
Decl. +52° 35′.

A and B.

	°	″			
1881.545	10.4	0.97	9.0..9.2	I	21:05
.556	....	0.81	8.5..8.6	I	19:40
.559	13.7	1.25	8.5..8.7	I	18:40
.578	12.9	0.96	8.5..8.5	II	20:40
1881.56	12.3	1.02	8.6..8.8		

A and C.

	°	″			
1881.556	.....	19.76	.....10.8	I	19:45
.559	307.9	19.40	.....10.5	I	19:45
.578	307.1	20.32	.....11.0	II	20:45
1881.56	307.5	19.83	.....10.8		

No. 60. D. M. (38°) 5112.

R. A. 23h 55m 17s.
Decl. +38° 58′.

	°	″			
1881.698	123.1	0.51	8.5..9.0	III	20:55
.717	125.1	0.65	8.5..9.0	III	20:20
.731	124.2	0.69	8.5..8.8	III	22:00
1881.71	124.1	0.62	8.5..8.9		

VI. A LIST OF 88 NEW DOUBLE STARS DISCOVERED AND MICROMETRICALLY MEASURED AT THE WASHBURN OBSERVATORY FROM APRIL 23 TO SEPTEMBER 30, 1881, BY MR. S. W. BURNHAM.

β. 776. D. M. (49°) 40.

R. A. 0h 10m 53s.
Decl. +49° 55′.

	°	″			
1881.575	202.8	0.79	9.0..9.3	III	19:55
.578	201.4	0.93	8.5..8.6	II	20:55
.616	203.3	0.97	9.0..9.2	II	20:45
1881.59	202.5	0.90	8.8..9.0		

β. 777. D. M. (−1°) 32.

R. A. 0h 14m 57s.
Decl. −0° 55′.

	°	″			
1881.728	164.5	4.24	8.5..10.0	I	0:35
.731	168.1	4.06	8.5.. 9.0	I	23:20
.747	167.4	3.97	8.5.. 9.5	I	22:20
1881.73	166.7	4.09	8.5.. 9.5		

β. 778. D. M. (51°) 72.

R. A. 0h 19m 43s.
Decl. +51° 10′.

	°	″			
1881.578	47.6	1.04	9.5..9.5	II	21:10
.589	49.6	1.02	9.5..9.5	I	23:35
.652	46.5	1.09	9.5..9.5	II	20:30
1881.61	47.9	1.05	9.5..9.5		

β. 779. Ll. 592.

R. A. 0h 21m 36s.
Decl. + 22° 55′.

	°	″			
1881.641	261.0	0.81	9.0.. 9.0	III	0:00
.668	266.9	0.99	8.0.. 9.2	III	20:45
.709	262.0	0.74	8.4.. 8.8	III	22:55
1881.67	263.3	0.85	8.5.. 9.0		

β. 780. D. M. (36°) 79.

R. A. 0h 26m 0s.
Decl. +37° 5′.

	°	″			
1881.728	.....	2.41	8.5..10.0	I	20:05
.731	143.4	2.14	8.5..10.0	I	22:25
.747	145.1	2.42	8.6.. 9.5	I	20:50
1881.73	144.2	2.32	8.5.. 9.8		

β. 781. Ll. 1337.

R. A. 0h 44m 0s.
Decl. +68° 20′.

	°	″			
1881.499	33.1	1.10	8.0.. 8.5	II	10:10
.504	30.2	1.08	8.0.. 8.5	II	18:36
.529	30.3	0.93	8.3.. 8.7	II	18:05
1881.51	31.2	1.04	8.1.. 8.6		

β. 782. Ll. 2357.

R. A. 1h 13m 18s.
Decl. +55° 35′.

	°	″			
1881.545	79.2	3.02	8.0.. 9.3	I	20.40
.575	79 9	2.87	8.0..10.0	II	20.40
.608	78.6	2.97	8.0.. 9.5	II	30.35
1881.57	79.2	2.95	8.0.. 9.6		

β. 783. O. Arg. 1777.

R. A. 1h 32m 26s.
Decl. +73° 56′.

	°	″			
1881.709	319.0	0.90	8.7..9.0	III	23.45
.711	311.8	1.05	8.4..8.8	III	20.40
.714	322.7	0.96	8.5..8.8	II	21.00
.717	318.3	0.81	8.6..9.0	III	19.20
1881.71	318.0	0·93	8.5..8.9		

β. 784. D. M. (22°) 269.

R. A. 1h 39m 33s.
Decl. +22° 20′.

	°	″			
1881.698	44.9	1.67	8.7..9.5	II	21.40
.709	48.3	1.80	8.8..9.5	II	22.25
.731	46.8	2.11	9.2..9.6	I	22.25
1881.71	46.7	1.86	8.9..9.5		

β. 785. 49 Cassiopeæ.

R. A. 1h 54m 4s.
Decl. +75° 32′.

	°	″			
1881.668	244.2	5.27	6.0..13	I	22:35
.695	246.7	5.25	6 0..13	I	18:50
.714	245.2	5.13	6.0..13	I	20:40
.717	246.6	5.19	6.0..12.5	I	19:15
1881.70	245.7	5.22	6.0..13		

β. 786. D. M. (55°) 563.

R. A. 2h 9m 18s.
Decl. +55° 12′.

	°	″			
1881.555	.....	4.89	8.4.. 9.0	I	20:40
.559	353.9	5.04	8.5..10.2	I	20:35
.575	352.2	4.95	8.6..10.5	I	20:50
.698	352.8	4.68	8.5..10.0	I	21:00
1881.57	353.0	4.89	8.5..9.9		

β. 787. Ll. 6473.

R. A. 3h 25m 39s.
Decl. +48° 13′.

	°	″			
1881.668	232.2	2.23	8.0..12.0	II	23:10
.695	227.5	2.18	8.0..12.0	I	22:25
.799	225.9	1.75	8.0..12.0	II	20:35
1881.69	228.5	2.05	8.0..12.0		

β. 788. D. M. (42°) 786.

R. A. 3h 27m 10s.
Decl. +42° 10′.

A and B.

	°	″			
1881.668	306.1	2.62	8.0..11.0	I	0:00
.698	305.6	3.01	8.5..11.0	I	22:35
.698	307.2	2.64	8.5..10.0	I	22:15
.709	305.9	2.86	8.4..10.0	I	22:40
1881.69	306.2	2.78	8.3..10.5		

A. and C.

	°	″			
1881.668	82.3	34.17	.....9.0	I	22:40
.695	82.0	34.23	... .9.0	I	22:40
.698	82.4	34.79	.....8.6	I	22:20
.709	82.2	34.57	.....8.5	I	22;50
1881.69	82.2	34.44	.....8.8		

β. 789. L¹. 8426.

R. A. 4h 23m 30s.
Decl. +37° 24′.

	°	″			
1881.668	322.9	1.34	8.3..8.8	III	0:20
.695	323.0	1.28	8.0..9.0	II	23:15
.709	321.9	1.27	8.0..8.5	II	23:25
1881.69	322.6	1.30	8.1..8.8		

β. 790. Anon.

R. A. 10h 4m 5s.
Decl. — 12° 17′.
Place from Berlin Catalogue.

	°	″			
1881.342	67.4	2.19	8.5..9.5	I	.....
.356	69.0	2.20	8.8..10.8	II	11:20
.389	67.3	2.12	8.5..10.0	I	12:20
1881.36	67.9	2.17	8.6..10.1		

β. 791. Anon.

R. A. 11h 14m 50s.
Decl. +7° 43′.
Place from Lamont's zones.

	°	″			
1881.293	201.5	2.10	8.3..10.0	II	13:05
.329	197.9	2.37	8.0..10.5	II	11:15
.441	200.4	1.71	8.5..10.5	I	11:35
1881. 32	199.9	2.06	8.3..10.3		

β. 792. Schj. 4219.

R. A. 11h 35m 31s.
Decl. +3° 33′.

	°	″			
1881.331	204.9	1.74	8.5..11.0	I	11:45
.342	203.3	2.16	8.0..11.0	I	11:15
.453	205.2	1.85	8.5 11.0	II	12:00
1881. 34	204.5	1.92	8.3..11.0		

β. 793. D. M. (7°) 2474.

R. A. 11h 37m 26s.
Decl. +7° 14′.

	°	″			
1881.293	120.3	1.17	9.5..10.0	II	12:45
.340	112.0	1.35	9.7..10.5	II	12:00
.342	110.3	1.43	9.5..10.5	II	11:10
1881. 32	114.2	1.32	9.6..10.3		

β. 794. O. Arg. 12149.

R. A. 11h 47m 13s.
Decl. +74° 26′.

A naked-eye star, 6–7m. according to Heis.

	°	″				
1881.301	105.8	0.54	6.5..7.5	IV	10:00	
.304	105.3	0.44	6.5. 8.0	IV	9:40	
.318	110.5	0.34	6.5..8.0	IV	9:35	Daylight.
.378	113.2	0.43	6.3..7.5	IV	12:30	Cloudy.
.381	98.0	0.36	6.5..8.0	IV	11:30	Daylight.
1881 34	106.6	0.42	6.5..7.8			

β 795. R. 2778. (AB=OΣ 242.)

R. A. 11h 53m 51s.
Decl. +71° 20′.

A. and B.

	°	″			
1881.266	150.7	.....	7.5..7.5	III	......
.274	151.0	33.75	7.5..7.5	II	10:40
273	151.4	33.55	8.0..8.0	II	11:24
.382	150.4	33.47	7.7..7.7	12	12:30
1881.30	150.9	33.59	7.7..7.7		

A. and *a.*

	°	″			
1881.266	325.0	.....	....	III	......
.273	329.5	13.23	.....13..	II	10:45
.293	329.6	14.08	.....13..	II	11:35
.383	324.0	14.15	.....13.	II	12:50
1881.30	327.0	13.82	.....13..		

B. and *b.*

	°	″			
1881.266	115.1	....	.....12.5	II	......
.274	115.2	6.14	.....13..	II	10:30
.293	114.5	5.44	.....12..	II	11:30
.383	120.1	5.75	.....12.5	II	12:40
1881.30	116 2	5.78	.....12.5		

β. 796. Ll. 23014.

R. A. 12h 11m 19s.
Decl. +7° 16′.

A very close and difficult pair.

	°	″			
1881.293	267.1	0.25 est.	8.0..8.0	IV	11:40
.324	275.7	0.38	8.0..9.0	IV	11:40
.386	269.8	0.24	8.0..9.5	IV	12:55
1181.34	270.9	0.31	8.0..8.8		

β. 797. D. M. (6°) 2630.

R. A. 12h 28m 27s.
Decl. +6° 38′.

A and B.

	°	″			
1881.293	169.8	0.80	8.3..8.3	III	13:20
.304	171.1	0.66	8.5..8.7	III	13:40
.331	172.7	0.73	8.7..8.7	IV	13:40
1881.31	171.2	0.73	8.5..8.6		

AB and C.

	°	″			
1881.293	3.5	77.25	.....9.0	III	13:30
.304	3.0	77.21	.....9.0	III	13:20
.329	3.2	77.41	....	II	10:00
1881.31	3.2	77.29	.....9.0		

β. 798. Ll. 24307.

R. A. 12h 59m 40s.
Decl. —17° 21′.

	°	″				
1881.342	177.4	0.62	8.0..8.0	III	12:30	
.353	163.5	0.73	8 0..8.0	II	12:30	Poor seeing.
.392	175.0	0 35	8.0..9.0	IV	13:20	Very difficult.
.397	181.0	0.45	8.5..9.0	III	14:10	
.419	174.7	0.56	8.0..8.3	III	13:20	
1881.38	174.3	0.54	8.1..8.5			

β. 799. R. 2963.

R. A. 13h 1m 7s.
Decl. +73° 40′.

A naked-eye star according to Heis, 6–7m.

	°	″				
1881.299	.....	0.73	7.0..8.5	IV	12:20	
.304	238.5	0.63	6.0..8.5	III	10:00	
.318	239.2	0.45	6.5. 8.5	IV	9:45	Daylight.
.378	238.4	0.53	6.5..8.0	IV	13:10	Cloudy.
.381	238.8	0.49	6.5..8.5	IV	11:40	
1881.34	238.7	0.57	6.5..8.5			

β. 800. Comæ 201.

R. A. 13h 10m 49s.
Decl. +17° 40′.

	°	″			
1881.304	120.4	1.25	7.0..10.5	III	13:50
.353	119.3	1.11	7.0..10.0	IV	13:15
.373	126.1	1.49	7.5..10.0	III	16:25
.419	120.0	1.21	7.0..10.5	III	14:15
1881.36	121.5	1.27	7.1..10.2		

β. 801. Ll. 25399.

R. A. 13h 40m 43s.
Decl. +11° 26′.

	°	″			
1881.293	329.4	2.63	8.0..11.0	II	14:20
.304	328.6	2.83	8.2..10.8	IV	10:20
.331	325.9	2.81	8.0..10.8	I	13:55
1881.31	328.0	2.76	8.1..10.9		

β. 802. D. M. (49°) 2245.

R. A. 13h 43m 49s.
Decl. +48° 57′.

	°	″			
1881.301	223.5	3.30	7.6..11.0	II	10:42
.304	222.8	3.55	7.8 .11.0	II	11:00
.383	225.5	3.43	8.0..10.8	II	13:10
1881. 33	223.9	3.43	7.8. 11.0		

β. 803. Ll. 25991.

R. A. 14h 4m 46s.
Decl. —2° 6′.

	°	″			
1881.447	227.9	5.27	7.8..12.0	I	15:00

β. 804. Anon.

R. A. 14h 31m 42s.
Decl. —8° 9′.

Place from Berlin Catalogue.

	°	″			
1881.433	167.9	1.47	8.2..10.5	II	15:25
.396	164.5	1.33	8.0..11.0	II	15:00
1881. 46	166.2	1.40	8.1..10.7		

β. 805. O. Arg. 13799.

R. A. 14h 32m 58s.
Decl. —26° 38′.

A. and B.

	°	″			
1881.397	135.9	23.01	7.5..13	II	15:00
.417	134.9	25.24	7.0..13	I	15:07
1881.41	135.4	24.12	7.2..13		

A. and C.

	°	"			
1881.397	42.2	124.12	......9.0	II	15:10
.419	41.7	124.14	......9.5	I	15:05
.438	42.0	123.68	... ..9.0	I	14:40
1881.42	42.0	123.98	......9.2		

C. and D.

	°	"			
1881.397	240.0	1.85	12	II	14:55
.414	239.5	2.32	12	I	15:57
.498	239.6	1.80	11	I	15:20
1881.44	239.7	1.99	.....11.7		

β. 806. O. Arg. 13813.

R. A. 14h 33m 27s.
Decl. —25° 46′.

A. and B.

	°	"			
1881.397	67.6	71.70	......7.5	II	14:45
.419	67.3	71.57	......7.0	I	14:40
.438	67.4	71.20	......7.5	I	14:30
1881.42	67.4	71.50	......7.3		

B. and C.

	°	"			
1881.397	346.5	1.14	8.5..10.0	II	14:30
.419	344.6	1.26	8.5.. 9.5	I	14:50
.496	352.3	1.26	8.5.. 9.3	I	15:35
1881.44	447.8	1.22	8.5..9.6		

β. 807. Schj. 5216.

R. A. 14h 36m 37s.
Decl. —6° 18′.

	°	"			
1881.414	238.9	1.27	8.0..9.2	II	15:00
.416	238.0	1 30	8.0..9.0	I	14:00
.410	240.2	1.15	8.0..9.0	II	15:40
1881.41	239.0	1.24	8.0..9.1		

β. 808. Anon.

R. A. 14h 51m 46s.
Decl. — 8° 11′.

A and B.

	°	"			
1881.395	207.0	0.63	9.0..9.0	II	16:50
.496	196.1	0 63	9.0..9.0	II	15:50
1881.44	201.5	0.63	9.0..9.0		

A B and C.

1881.395	305.0	94.41	.....8.8	II	16:55
.438	305.2	94.80	.....9.0	I	14:50
1881.41	305.1	94.60	.....8.9		

β. 809. Anon.

R. A. 15h 3m 4s.
Decl. — 22° 16′.

Place from Washington Mural Zones.

	°	″			
1881.340	120.0	1.34	8.0..10.0	II	15:10
.342	123 3	1.58	7.8.. 9.0	I	13:40
.370	116.1	1.61	8.0.. 9.0	III	15:25
.370	121.2	1.36	8.0.. 9.3	III	15:40
1881.36	120.1	1.47	8.0.. 9.3		

β. 810. W_2 B. XV. 1156.

R. A. 15h 46m 55s.
Decl, + 42° 50′.

	°	″			
1881.274	94.5	0.94	8.3..11.0	II	13:55
.304	91.9	1.28	8.5..11.0	II	11:10
.383	93.2	1.04	8.8..11.5	III	13:20
1881.32	93.2	1.09	8.5..11.2		

β. 811. Ll. 29349.

R. A. 16h 0m 26s.
Decl. +22° 13′.

	°	″			
1881.304	223.2	3.73	8.0..11.8	II	15:30
.309	217.4	3.35	8.3..12.0	II	15:15
.331	224.3	3.40	8.0..12.5	I	14:50
1881. 31	221.6	3.49	8.1..12.1		

β. 812. W_2 B. XV. 1553.

R. A. 16h 1m 42s.
Decl. +17° 13′.

	°	″			
1881.304	128.1	0.76	8.5.. 8.8	III	15:40
.309	126.3	0.93	8.0.. 8.0	III	15:20
.331	127.8	0.92	8.0.. 8.0	II	15:00
1881. 31	127.4	0.87	8.2.. 8.3		

β. 813. W_2 B. XVI. 661.

R. A. 16h 23m 2s.
Decl. +26° 48′.

	°	″			
1881.280	164.8	0.85	... .		
.304	165.0	1.05	8.3.. 8.4	II	15:55
.309	166.5	0.97	8.4.. 8.4	II	16:10
1881. 30	165.4	0.96	8.4.. 84.		

β. 814. W_2 B. XVI. 676.

R. A. 16h 23m 9s.
Decl, +40° 9′.

	°	″			
1881.304	314.3	0.41	8.4..8.5	IV	12:00
.495	329.0	0.31	8.3..8.5	IV	13:45
.483	324.4	0.35	8.5..9.0	IV	13:40
1881.38	322.6	0.36	8.4..8.7		

β. 815. W_2 B. XVI. 686.

R. A. 16h 23m 16s.
Decl. +43° 11′.

	°	″			
1881.280	348.5	6.03	8.0..10.5	II	.....
.304	349.7	6.49	8.3..10.8	II	11:25
.309	347.0	6.73	8.0..10.0	II	15:50
1881.30	348.4	6.42	8.1..10.4		

β. 816. 31 Herculis.

R. A. 16h 26m 58s.
Decl. +33° 46′.

	°	″			
1881.280	225.0	4.87	7.0..11.0	I	13:50
.304	224.7	4.72	6.0..12.5	I	12:25
.309	222.7	5.32	6.0..11.8	II	15:40
1881.30	224.1	4.97	6.3..11.8		

β. 817. W_2 B. XVI. 796.

R. A. 16h 27m 29s.
Decl. + 23° 29′.

	°	″			
1881.280	149.1	0.96	8.3..8.3		
.304	147.1	1.17	8.0..8.0		16:15
.309	146.5	1.09	8.3..8.5		14:30
.331	145.5	1.34	8.0..8.0	II	15:30
1881.31	147.0	1.14	8.2..8.2		

β. 818. 32 Herculis.

R. A. 16h 28 m 50s.
Decl. + 30° 45′.

	°	″			
1881.433	31.8	2.92	6.0..13	I	.....
.458	38.9	3.61	6.3..13–14	I	.....
.556	29.9	3.35	6.5..13.5	I	18:00
1881.48	33.5	3.29	6.3..13.5		

The small star is excessively faint, and was invisible, or not measurable, on many nights when it was looked for.

β. 819. Anon.

R. A. 16h 30m 26s.
Decl. — 4° 55′.

	°	″			
1881.395	235.9	1.45	8.5..11.5	I	17:10
.417	224.3	1.65	8.5..11.5	I	16:15
.496	232.3	1.67	8.7..11.0	I	16:15
1881.44	230.8	1.59	8.6..11 3		

β. 820. Ll. 30279.

R. A. 16h 33m 9s.
Decl. — 2° 52′.

	°	″			
1881.340	237.8	4.19	7.8..9.5	II	16:10
.342	237.8	4.29	8.0..9.5	II	13:15
.373	237.1	4.25	8.0..9.5	II	15:50
1881.35	237.6	4.24	8.0..9.5		

β. 821. D. M. (32°) 2799.

R. A. 16h 47m 13s.
Decl. +32° 3′.

	°	″			
1881.414	312.5	1.35	8.5..9.0	I	16:35
.433	314.7	1.16	8.3..8.7	II	14:10
.458	313.5	1.13	8.5..9 0	III	14:45
1881.43	313.6	1.21	8.4..8.9		

β. 822. Herculis 198.

R. A. 16h 58m 39s.
Decl. +19° 51′.

	°	″			
1881.554	227.9	1.44	7.0..11.0	III	18:25
.562	227.4	1.55	6.8..11.5	III	18:40
.578	228.6	1.52	7.0..11.5	III	19:30
1881.56	228.0	1.50	6.9..11.3		

β. 823. Ll. 31107.

R. A. 17h 0m 29s.
Decl. +0° 40′.

	°	″			
1881.340	351.0	0.98	8.0..9.0	II	16:50
.373	852.7	1.11	8.5..9.0	III	15:55
.430	354.7	0.92	8.5..9.5	II	17:15
.483	356.4	1.17	8.0..9.3	II	16:50
1881.39	353.9	1.04	8.2..9.2		

β. 824. D. M. (—1°) 3400.

R. A. 17h 42m 39s.
Decl. —1° 45′.

	°	″			
1881.340	353.8	0.73	8.5..8.6	II	17:15
.373	347.9	0.69	8.5..8.6	III	16:20
.496	351.0	0.58	8.5..8.6	III	17:10
1881.40	350.9	0.67	8.5..8.6		

β. 825. (Ac.= Σ 2268.)

R. A. 17h 58m 20s.
Decl. +25° 22′.

There is a minute star between the components observed by Struve.

A and B.

	°	″			
1881.364	196.5	11.57	8.5..13	I	16:40
.370	199.3	11.55	8.5..12.5	I	17:50
.373	197.4	11.11	8.3..13	I	17:05
1881.37	197.7	11.41	8.4..13		

A and C.

	°	″			
1881.364	212.6	19.97	8.5..8.7	I	16:35
.370	212.6	20.15	8.5..9.0	II	17:40
.373	212.4	20.12	8.3..8.7	I	17:00
1881.37	212.5	20.08	8.4..8.8		

β. 826. D. M. (9°) 3566.

R. A. 18h 2m 5s.
Decl. +9° 45′.

	°	″			
1881.503	337.5	0.70	9.5.. 9.6	II	18:00
.556	.....	0.54	9.8..10.0	III	19:00
.644	344.7	0.56	9.5.. 9.5	II	18:25
1881.57	341.1	0.60	9.6.. 9.7		

A very difficult pair of small stars; in the field, 5.′3 south of a 7m star.

β. 827. L¹. 37470.

R. A. 19h 37m 57s.
Decl. — 11° 29′.

	°	″			
1881.581	265.8	0.95	8.0..8.7	II	20:00
.638	268.4	0.78	8.3..9.5	III	18:10
.641	269.9	0.88	8.5..9.0	II	21:10
1881.62	268.0	0.87	8.3..9.1		

β. 828. D. M. (5°) 4290.

R. A. 19h 41m 3s.
Decl. +5° 52′.

	°	″			
1881.638	9.4	2.87	8.3..10.5	II	18.25
.641	10.9	2.69	8.4..10.5	II	18.45
.647	10.0	3.05	8.3.. 9.5	I	19.20
1881.64	10.1	2.87	8.3..10.2		

β. 829. D. M. (5°) 4299.

R. A. 19h 43m 1s.
Decl. +5° 27′.

	°	″			
1881.641	308.9	0.75	8.4..8.8	III	18:55
.647	315.0	0.87	8.3..8.7	III	19:25
.666	312.1	0.55	8.5. 8.8	IV	18:45
1881.65	312.0	0.72	8.4..8.8		

β. 830. L¹. 37916.

R. A. 19h 49m 2s.
Decl. —1° 9′.

	°	″			
1881.731	107.5	2.77	8.0..11.5	II	20:00
.747	105.4	2.67	8.0..11.0	II	19:40
1881.74	106.4	2.72	8.0..11.2		

β. 831. D. M. (47°) 2955.

R. A. 19h 51m 59s.
Decl. +47° 4′.

	°	″			
1881.455	128.9	1.11	8.5..9.0	III	16:15
.465	127.0	0.74	8.7..9.0	II	16:30
.471	128.0	0.97	8.6..9.0	II	15:50
1881.46	128.0	0.94	8.6..9.0		

β. 832. Lamont 3095.

R. A. 20h 0m 5s.
Decl. — 10° 59′.

	°	″			
1881.638	102.9	1.33	8.7..9.0	II	21:30
.644	101.0	1.40	8.5..8.8	II	19:50
.668	101.6	1.29	8.5..8.8	II	19:05
1881.65	101.8	1.34	8.6..8.9		

β. 833. Ll. 38625.

R. A. 20h 5m 11s.
Decl. — 6° 30′.

A. and B.

	°	″			
1881.731	63.3	118.73	..8.4	I	20:20
.747	63.7	118.44	..8.5	I	19:35
1881.74	63.5	118.58	..8.4		

B and C.

	°	″			
1881.731	63.8	2.35	8.8..11.5	I	20:15
.747	63.5	2.25	8.8..12.0	I	19:30
1881.74	63.7	2.30	8.8..11.7		

β. 834. D. M. (6°) 4638.

R. A. 20h 39m 47s.
Decl. +6° 43′.

	°	″			
1881.455	136.3	2.34	8.5..11.0	I	19:25
.504	136.4	2.66	8.3. 11.0	I	21:35
.562	132.4	2.39	8.6..11.0	III	17:04
.641	136.6	2.45	8.3..11.5	I	20:45
.647	130 1	2.58	8.6..12.0	I	19:35
.666	132.7	2.22	8.5..10.8	I	18:50
1881.58	134.0	2.44	8.5..11.0		

β. 835. Ll. 40815.

R. A. 20h 58m 39s.
Decl. +7° 17′.

	°	″			
1881.641	256.4	0.85	8.0..11.0	II	20:00
.666	256.4	0.88	8.0..11.0	III	19:00
668	254.3	0.79	8.0..11.0	III	20:25
1881.66	255.7	0.84	8.0..11.0		

β. 836. D. M. (47°) 3291.

R. A. 21h 2m 27s.
Decl. +47° 54′.

A and B.

	°	″			
1881.575	191.6	0.53	9.0..9.0	III	17:4C
.589	193.0	0.64	9.0..9.0	III	18:35
.717	189.6	0.68	9.0..9.3	III	19:55
1881.63	191.4	0.62	9.0..9.1		

A, B and C.

	°	″			
1881.575	218.5	27.28	..10.5	III	17:45
.589	218.1	27.41	..10.0	III	18:30
.717	220.8	27.46	..10.0	II	20:00
1881.63	219.1	27.38	..10.2		

The distant star, C, may be a close pair.

β. 837. D. M. (−1°) 4170.

R. A. 21h 2m 43s.
Decl. −0° 16′.

	°	″			
1881.728	186.6	3.76	8.3..10.0	I	21:30
.731	190.9	3.81	8.6..10.3	II	21:05
.747	190.8	3.54	8.4..10.0	II	19:50
1881.73	189.7	3.70	8.4..10.1		

β. 838. Ll. 41462.

R. A. 21h 14m 51s.
Decl. +2° 37′.

	°	″			
1881.644	92.7	1.25	7.6..9.5	III	20:30
.666	89.4	1.34	7.5..9.5	III	19:16
.668	88.9	1.28	7.8..9.5	I	20:15
1881.66	90.3	1.29	7.6..9.5		

β. 839. D. M. (48°) 3348.

R. A. 21h 16m 10s.
Decl. +48° 50′.

A and B.

	°	″			
1881.455	201.2	15.11	8.5..12.0	I	16:55
.465	203.7	.....	8.5..12.0	I	15:35
.490	200.3	15.24	8.5..12.0	I	17:35
1881.47	201.7	15.18	8.5..12.0		

A and C.

	°	″			
1881.455	196.1	21.19	. 9.5	I	16.50
.465	197.0	21.57	.9.5	I	15.30
.490	197.8	21.61	..9.3	I	17.30
1881.47	197.0	21.46	..9.4		

β. 840. Lamont 8586.

R. A. 21h 46m 10s.
Decl. −2° 17′.

	°	″			
1881.728	39.9	2.55	8.8..10.0	I	22:20
.731	38.1	2.71	8.8.. 9.0	I	21:15
.747	40.2	2.46	8.5..10.5	II	21:05
1881.73	39.4	2.57	8.7..10.0		

β. 841. D. M. (53°) 2628.

R. A. 21h 49m 21s.
Decl. +53° 44′.

	°	″			
1881.490	190.0	1.73	8.5..11.0	I	17:10
.493	196.0	2.32	8.7..11.5	I	20:20
.711	197.2	2.03	8.4..12.0	I	19:10
1881.56	194.4	2.03	8.5..11.5		

β. 842. D. M. (4°) 4811.

R. A. 22h 3m 30s.
Decl. +5° 6′.

	°	″			
1881.728	123.2	1.26	8.5..9.0	I	22:50
.731	119 4	1.21	8.8..9.0	II	21:25
.747	122.7	1.32	9.0..9.3	II	20:10
1881.73	121.1	1.26	8.8..9.1		

β. 843. D. M. (+1°) 4606.

R. A. 22h 18m 43s.
Decl. +2° 3′.

	°	″			
1881 .638	237.5	3.60	8.3..12.5	I	21:00
.641	237.6	3.33	8.4..12.5	I	22:05
.666	233.1	3.45	8.4..12.5	I	19:20
1881.65	236.1	3.46	8.4..12.5		

β. 844. Ll. 43912.

R. A. 22h 23m 32s.
Decl. +5° 2′.

A and B.

	°	″			
1881.728	34.2	98.14	..8.0	I	23:00
.731	34.2	98.41	..8.3	I	21:35
.747	34.4	98.47	..8.0		
1881.73	34.3	98.34	..8.1		

B. and C.

	°	″			
1881.728	316.6	2.93	8.8..10.5	I	23:05
.731	316.3	3.34	9.5..11.5	I	21:30
.747	318.5	3.33	9.5..10.8		
1881.73	317.1	3.20	9.3..10.9		

β. 845. O. Arg. 24536.

R. A. 22h 36m 26s.
Decl. +67° 53′.

A and B.

	°	″			
1881.529	194.9	5.91	8.0..11.8	I	19:20
.531	194.7	5.38	8.2..12.5	I	18:15
.540	.....	5.77	8.2..12.0	II	17:00
.542	196.7	5.70	8.3..12.0	I	18:05
1881.53	195.4	5.69	8.2..12.1		

A and C.

	°	″			
1881.540	...	15.66	..13.	II	17:10
.542	9.1	15.35	..13.5	II	18:15
1881.54	9.1	15.50			

β. 846. Ll. 44688.

R. A. 22h 44m 33s.
Decl. +23° 54′.

In a low power field with μ Pegasi, 21sf and 5′s.

	°	″			
1881.562	93.2	1.76	8.5..12.5	I	20:40
.575	90.1	1.68	8.7..12.0	II	22:30
.586	97.0	1.75	8.5..12.0	I	19:45
1881.57	93.4	1.73	8.6..12.2		

β. 847. W. XXII. 1103.

R. A. 22h 48m 45s.
Decl. +19° 42′.

	°	″			
1881.641	36.7	6.44	8.4..9.0	II	21:50
.644	37.4	6.48	8.4..9.0	I	21:35
.647	38.2	6.25	8.7..9.5	I	19:45
1881.64	37.4	6.39	8.5..9.2		

β. 848. D. M. (57°) 2629.

R. A. 22h 49m 58s.
Decl. +57° 44′.

	°	″			
1881.652	8.1	2.68	8.3..13	II	19:40
.668	3.0	3.03	8.3..12.5	II	21:40
.695	6.3	2.59	8.5..13	I	19:50
1881.67	5.8	2.77	8.4..12.8		

β. 849. O. Arg. 24920.

R. A. 22h 51m 46s.
Decl. +66° 11′.

	°	″			
1881.529	131.1	3.80	8.3..12.0	I	18:50
.531	128.5	4.12	8.3..12.0	I	18:00
.540	.....	3.76	8.5..12.5	I	16:30
.542	121.5	3.27	8.0..12.5	I	18:50
1881.53	127.0	3.74	8.4..12.3		

β. 850. Ll. 44985.

R. A. 22h 54m 21s.
Decl. +13° 13′.

	°	″			
1881.562	118.8	2.96	8.2..10.8	II	20:30
.578	120.0	3.11	8.0 10.5	II	20:00
.581	120.6	3.07	8.2..10.5	I	20:55
1881.57	119.8	3.05	8.1..10.6		

β. 851. O. Arg. 25054.

R. A. 22h 57m 36s.
Decl. +75° 29′.

	°	″			
1881.652	162.4	1.81	7.7..13	I	21:10
.668	157.0	1.65	7.7..13	II	21:40
.695	154.7	1.61	7.0..13	I	19:10
1881.67	158.0	1.69	7.5..13		

β. 852. Pegasi 306.

R. A. 23h 4m 50s.
Decl. +25° 52′.

A and B.

	°	″			
1881.575	281.8	58.24	.. 7.0	I	22:55
.616	283.2	58.89	.. 7.0	II	20:25
.641	282.8	58.51	.. 7.0	I	21:35
1881.61	282.6	58.55	.. 7.0		

B and C.

	°	″			
1881.575	10.7	1.17	11.0..11.5	I	23:00
.616	9.8	1.14	10.5..11.0	II	20:30
.666	13.1	1.28	10.0..11.5	I	19:50
1881.62	11.2	1.20	10.8..11.3		

β. 853. O. Arg. 25370.

R. A. 23h 11m 37s.
Decl. +61° 9′.

A and B.

	°	″			
1881.619	228.1	0.68	8.5..8.5	II	18:40
.668	229.4	0.57	9.0..9.0	III	21:20
1881.64	228.8	0.62	8.7. 8.7		

A, B and C.

	°	″			
1881.668	67.3	7.34	..13	II	21:30

β. 854. D. M. (5°) 5164.

R. A. 23h 18m 13s.
Decl. +5° 23′.

	°	″			
1881.641	90.3	2.10	8.8..8.8	III	22:50
.666	90.7	2.20	8.7..8.7	II	19:35
.668	89.0	2.01	8.6..8.6	I	20:05
1881.66	90.0	2.10	8.7..8.7		

β. 855. D. M. (67°) 1546.

R. A. 23h 32m 18s.
Decl. +67° 33′.

	°	″			
1881.529	201.5	0.71	8.3..8.8	III	19:55
.531	203.1	0.83	8.5..8.7	II	18:35
.540	204.9	0.93	8.5..9.0	III	17:30
.542	207.1	0.80	8.5..8.7	II	19:45
1881.53	204.2	0.82	8.5..8.8		

β. 856. O. Arg. 25859

R. A. 23h 33m 2s.
Decl. +69° 58′.

	°	″			
1881.529	265.2	0.58	8.0..9.3	III	20:45
.575	266.8	....	8.3..9.0	III	19:25
1881.55	266.0	0.58	8.1..9.1		

β. 857. D. M. (66°) 1630.

R. A. 23h 35m 0s.
Decl. +66° 53′.

	°	″			
1881.529	297.1	1.27	8.3..8.8	II	19:40
.531	297.7	1.34	8.5..9.0	II	18:25
.540	297.4	1.42	8.5..8.8	III	17:16
.542	295.4	1.52	8.5..8.9	I	19:30
1881.53	296.9	1.39	8.5..8.9		

β. 858. Ll. 46423. (Ac. = β. 389.)

R. A. 23h 35m 18s.
Decl. +31° 54′.

A and B.

	°	″			
1881.562	277.4	0.65	7.5..8.0	III	21:20
.575	273.5	0.40	8.0. 8.5	IV	21:30
.586	278.8	....	8.0..8.0	III	20:10
1881.57	276.6	0.48	7.7..8.2		

A, B and C.

	°	″			
1881.562	49.6	23.01	..12.5	III	21:30
.586	52.4	23.59	..13.0	II	20:00
.714	50.9	24.38	..12.5	II	20:00
1881.62	51.0	23.66	..12.8		

β. 859. W. XXIII. 961.

R. A. 23h 46m 35s.
Decl. +22° 18′.

	°	″			
1881.641	215.5	0.54	8.5..8.5	III	23:30
.668	215.8	0.69	8.4..8.6	III	20:35
.709	220.6	0.66	8.5..8.5	III	23:10
1881.67	217.3	0.63	8.5..8.5		

β. 860. Andromedæ 6. Ll. 47049.

R. A. 23h 53m 54s.
Decl. +38° 11′.

	°	″			
1881.714	108.4	6.58	6.7..11.5	II	20:15
.717	108.4	6.79	6.5..11.5	I	20:15
.728	105.0	6.89	7.0..11.5	I	19:45
.731	106.9	6.55	7.0..12.0	II	22:10
1881.72	107.2	6.70	6.8..11.6		

β. 861. D. M. (68°) 1422.

R. A. 23h 56m 55s.
Decl. +69° 2′.

	°	″			
1881.529	178.3	1.22	9.0.. 9.3	II	20:10
.531	178.9	1.24	9.5.. 9.7	I	18:45
.540	179.1	1.32	9.5..10.0	I	17:35
.542	173.2	1.41	9.5.. 9.8	II	20:00
1881.53	177.4	1.30	9.4.. 9.7		

β. 862. W. XXIII. 1245.

R. A. 23h 58m 36s.
Decl. +37° 30′.

	°	″			
1881.731	102.2	0.57	8.5..8.7	III	22:45
.747	107.6	0.52	8.5..9.0	III	20:55
1881.74	104.9	0.54	8 5..8.8		

β. 863. D. M. (72°) 1139.

R. A. 23h 59m 42s.
Decl. +72° 55′.

	°	″			
1881.531	125.9	1.75	9.0..11.0	I	20:25
.575	122.7	1.52	9.5..11.0	I	19:40
.608	122.6	1.53	9.0..11.0	I	20:30
1881.57	123.7	1.60	9.2..11.0		

VII. MEASURES OF DOUBLE STARS SELECTED FROM HIS MS. GENERAL CATALOGUE OF DOUBLE STARS, AS SPECIALLY NEEDING OBSERVATION, BY MR. S. W. BURNHAM.

The following list contains measures of previously known double stars selected for observation on account of their difficulty, the absence of modern observations, etc., etc. The selection was made by Mr. BURNHAM from his *General Catalogue of Double Stars*, which is at present in manuscript. This important work should be published, in order to make it available to astronomers.

In these observations two observers participated, thereby saving much of the time usually consumed in moving the dome and observing chair, setting the instrument, reading the circles and chronometer, recording the observations and taking the means of the separate settings.

By these means from 25 to 30 stars can be completely observed in one night.

All of the actual micrometric measures have been made by Mr. BURNHAM with the CLARK micrometer. The eye-pieces used were as below:

I. Magnifying Power, 195 diameters; field 11′.6.
II. Magnifying Power, 260 diameters; field 8′.6.
III. Magnifying Power, 430 diameters; field 5′.6.
IV. Magnifying Power, 750 diameters; field 3′.6.

S. 387. (8.4 and 8.4).

R. A. 0h 28m 37s.
Decl. +18° 14′.

	°	″			
1881.622	233.1	42.29	8.3..8.3	I	21:20
.644	232.4	42.08	8.5..8.5	I	21:45
.698	232.4	42.33	8.5..8.5	I	21:20

The only measures are:

	°	″	
1824.83	232.0	42.51	S.
1881.65	232.6	42.23	β.

; Andromedæ. 125. Σ. 47.

R. A. 0h 33m 59s.
Decl. +23° 24′.

A and B.

	°	″			
1881.622	206.1	16.33	8.0..9.0	I	21:05
.644	205.2	16.40	......	I	21:50
.647	205.6	16.34	7.8..8.6	I	20:25
1881.64	205.6	16.35			

A and C.

	°	″			
1881.644	229.0	42.23	....	I	21:55
.647	229.1	42.29	....	I	20:35
1881.64	229.0	42.26			

B and C.

	°	″			
1881.622	243.6	27 66	..9.7	I	21:10
.644	243.5	28.18	.....	I	23:00
.647	243.0	27.81	..9.5	I	20:30
1881.64	243.4	27.88			

With the exception of a single observation of A B, by Madler, there are no measures since Struve. The third star, C, was only incidentally noted by Σ. 41″.3 distant in 227°.7. There appears to be no change in A. B.

	°	″	
1832.44	204.7	16.51	Σ. 4 nights.
1881.64	205.6	16.35	β. 3 nights.

H. v. 82. (7.9 and 8.1.)

R. A. 0h 40m 38s.
Decl. +50° 27′.

	°	″				
1881.608	76.6	50.46	7.8..8.0	I	19:10	
.610	77.1	.....	....	I	20:20	Clouded.
.616	77.4	49.82	8.0..8.2	II	21:10	
.619	76.7	50.18	8.0..8.1	II	19:10	

The change is probably due to proper motion.

	°	″	
1783.05	82.2	43.43	*H.* 1 night.
1823.81	78.5	47.14	Sh. 1 nights.
1874.65	77.1	49.64	De. 2 nights.
1881.61	76.9	50.15	β. 3 nights.

D. M. (81°) 25. (8.0, 11.2 and 12.2.)

R. A. 0h 51m 43s.
Decl. +81° 14′.

A and B.

	°	″			
1881.266	62.0	.....	8.0..11.0	III	10:05
.269	60.9	14.23	8.0..	III	10:00
.285	63.1	13.64	8.0..10.7	IV	9:20
.293	63.4	13.88	8.0..11.0	IV	11:00
.468	62.2	13.40	7.8..12.0	I	15:50
1881.32	62.3	13.79			

A and C.

	°	″			
1881.266	322.0	20.97	..12	III	10:15
.269	322.9	20.72	....	III	10:20
.285	323.8	20.91	..12	IV	9:30
.468	322.0	22.29	..12.5	III	16:00
1881.32	322.7	21.22			

An interesting variable star, discovered by Ceraski in 1880, with a period of about 2½ days. The two faint companions were detected by Knott subsequently.

β. 396. (6.7 and 10.6.)

R. A. 0h 56m 13s.
Decl. +60° 26′.

	°	″			
1881.575	65.9	1.09	6.5..11.0	IV	20:50
.652	69.4	1.16	6.8..11.0	IV	19:00
.668	67.2	1.19	6.8..10.5	III	22:50

A difficult pair, discovered with the 6-inch. The following are all the measures:

	°	″	
1877.10	66.4	1.24	De. 4 nights.
1879.40	65.8	1.21	β. 4 nights.
1881.63	67.5	1.15	β. 3 nights.

β. 258. (7.2 and 10.2.)

R. A. 1h 5m 29s.
Decl. +61° 4′.

	°	″			
1881.575	267.0	0.80	7.7.. 9.5	III	21:05
.652	262.4	0.98	7.0..10.5	IV	19:05
.668	263.8	0.90	7.0..10.5	IV	23:00

A difficult pair. The following are all the measures:

	°	″	
1875.20	260.4	0.79	De. 4 nights.
1881.63	264.4	0.89	β. 3 nights.

Ψ. Cassiopeæ. Σ 117. (4.5, 9.9 and 10.2.)

R. A. 1h 17m 27s.
Decl. +67° 30′.

A and B.

	°	″			
1881.622	107.0	28.65	..4.5	I	19:05
.652	106.1	28.50	.....	III	19:15
.660	106.9	28.66	.....	I	22:20
.711	107.0	28.87	.....	I	21:30

B and C.

	°	″			
1881.622	258.3	2.97	10.0..10.3	I	19:00
.652	255.4	2.94	9.5.. 9.8	III	19:10
.660	254.7	3.35	10.0..10.5	I	22:05
.711	255.7	3.05	10.0..10.3	I	21:25

B. and C. probably form a binary system, the change with reference to A. being due to the proper motion of the large star. Some of the measures are:

A and B.

	°	″	
1831.04	101.8	32.22	Σ. 5 nights.
1865.50	105.1	29.74	De. 3 nights.
1881.66	106.8	28.67	β. 4 nights.

B and C.

	°	″	
1831.04	253.3	3.01	Σ. 5 nights.
1881.66	256.0	3.08	β. 4 nights.

Σ. 131. (7.1 and 9.7.)

R. A. 1h 25m 17s.
Decl. +60° 4′.

	°	″			
1881.608	143.0	13.79	6.7.. 9.5	I	20:05
.616	142.7	13.84	7.6..10.0	II	21:15
.619	142.9	13.79	....	II	18:55

The components have evidently remained fixed since the measures of Struve.

	°	″	
1830.27	142.4	13.64	Σ. 3 nights.
1881.61	142.9	13.81	β. 3 nights.

OΣ. 35. (6.8 and 10.5.)

R. A. 1h 36m 0s.
Decl. +55° 17′.

	°	″			
1881.608	106.3	10.92	7.0.. 9.5	I	20:10
.616	108.3	10.76	6.8..11.0	II	21:10
.619	106.1	11.11	6.7..11.0	II	19:20

The change shown by the following measures appears to be due to proper motion:

	°	″	
1847.54	115.4	9.84	OΣ. 3 nights.
1866.58	109.2	10.23	De. 3 nights.
1881.61	106.9	10.93	β. 3 nights.

Σ. 185. (7.7 and 8.5.)

R. A. 1h 51m 1s.
Decl. +74° 55′.

	°	″			
1881.652	27.4	1.30	7.5..8.0	III	20:30
.663	33.6	1.27	8.0..9.0	II	18:15
.668	28.6	1.35	7.7..8.5	III	20:25

The various measures of this pair are not very harmonious, but the two components certainly have a common proper motion, and probably form a binary system.

	°	″	
1831.95	40.3	1.39	Σ. 3 nights.
1836.71	34.9	1.38	Σ. 3 nights.
1872.31	33.8	1.79	OΣ. 1 night.
1881.66	29.9	1.31	β. 3 nights.

48 Cassiopeæ. β. 513.

R. A. 1h 52m 7s.
Decl. +70° 19′.

	°	″			
1881.668	271.9	0.76	6.0..7.5	IV	22:15

1878.70	264.4	1.04	β. 3 nights.
1878.69	265.1	1.05	De. 1 night.

The single measure, which was made under favorable conditions, would seem to indicate some change in both angle and distance.

47 Cassiopeæ. Sh. 22.

R. A. 1h 53m 6s.
Decl. +76° 42′.

	°	″			
1881.619	196.1	94.76	4.5..9.5	I	20:15
.622	196.3	95.35	5.0..9.0	II	18:50
.630	195.8	95.07	.....9.0	II	21:40

No other measures since Sh.

	°	″	
1821.97	192.3	93.59	Sh. nights.
1881.62	196.1	95.06	β. 3 nights.

Σ. 199. (8.6 and 8.7.)

R. A. 1h 55m 58s.
Decl. +67° 6′.

	°	″			
1881.619	21.4	36.09	8.5.. 8.7	I	20:20
.622	21.5	35.92	8.7.. 8.7	II	18:55
.630	21.5	36.09	....	II	21:50

Probably unchanged.

	°	″	
1831.59	21.0	35.76	Σ. 3 nights.
1881.62	21.5	36.03	β. 3 nights.

Σ. 230. (8.0 and 8.8.)

R. A. 2h 6m 28s.
Decl. +57° 55′.

	°	″			
1881.619	258.5	24.24	8.0.. 8.6	I	20:25
.622	258.5	24.51	8.0.. 9.0	I	19:20
.647	258.5	23.96	....	I	21:35

The following are all the measures. Evidently fixed:

1831.02	257.3	24.09	Σ. 2 nights.
1879.72	258.4	24.33	β. 2 nights.
1881.63	258.5	24.24	β. 3 nights.

Σ. 235. (8.6 and 8.7.)

R. A. 2h 8m 52s.
Decl. +55° 21′.

	°	″			
1881.556	.....	1.45	8.3.. 8.4	II	20:50
.559	46.6	1.59	8.5.. 8.6	I	20:40
.608	47.0	1.49	9.0.. 9.0	I	21:10

There may be some angular motion.

	°	″	
1830.87	43.4	1.71	Σ. 3 nights.
1858.95	45.2	1.58	Se. 2 nights.
1881.57	46.8	1.51	β. 3 nights.

OΣ. (App.) 26. (7.1 and 7.2.)

R. A. 2h 11m 2s.
Decl. +59° 28′.

	°	″			
1881.663	199.7	63.46	7.0..7.0	II	18:30
.666	199.5	63.30	7.0..7.2	I	20:35
.673	199.7	62.74	7.2..7.3	II	20:20

The only measures are:

	°	″	
1874.47	199.7	63.45	De. 2 nights.
1881.67	199.6	63.17	β. 3 nights.

Σ 256. (8.5, 9.3 and 9.0.)

R. A. 2h 15m 50s.
Decl. +48° 48′.

A and B.

	°	″			
1881.619	197.0	21.12	8.6..9.0	I	20:55
.663	196.4	21.10	8.5..9.3	I	20:35
.673	195.7	20.98	8.5..9.5	I	21:00

A and C.

	°	″			
1881.619	44.2	36.86	..9.0	I	20:50
.663	44.1	36.52	..9.0	I	20:40
.673	43.6	36.76	..9.0	I	21:05

The following are all the measures. Evidently unchanged:

A and B.

	°	″	
1831.98	195.5	21.10	Σ 2 nights.
1881.65	196.4	21.07	β 3 nights.

A and C.

	°	″	
1831.98	44.0	36.70	Σ. 2 nights.
1881.65	44.0	36.71	β. 3 nights.

OΣ. (App.) 28. (7.5 and 7.9.)

R. A. 2h 29m 37s.
Decl. +62° 4′.

	°	″			
1881.647	147.2	68.00	7.0..7.5	I	21:45
.652	146.9	67.78	7.8..8.0	II	20:05
.657	146.8	67.74	7.7..8.2	I	18:25

The only measures are:

	°	″	
1875 00	147.1	67.78	De. 3 nights.
1881.65	147.0	67.84	β. 3 nights.

Σ. 297. (8 2, 8.2 and 10.5.)

R. A. 2h 36m 39s.
Decl. +56° 3′.

A and B.

	°	″			
1881.663	277.4	16.19	8.0..8.2	I	20:20
.666	277.8	16.20	....	I	20:55
.673	277.6	16.36	8.3..8.3	I	20:45

A and C.

	°	″			
1881.663	107.1	28.55	...10.5	I	20:30
.666	107.2	28.40	....	I	21:00
.673	105.6	28.56	...10.5	I	20:00

The following are all the measures:

A and B.

	°	″	
1831.20	276.6	15.64	Σ. 5 nights.
1881.67	277.6	16.25	β. 3 nights.

A and C.

	°	″	
1830.95	106.8	28.35	Σ. 4 nights.
1881.67	106.6	28.50	β. 3 nights.

20 Persei. β. 524.

R. A. 2h 46m 9s.
Decl. +37° 51′.

A and B.

	°	″			
1881.668	334.9	0.28	6.0..6.5	IV	23:25

AB and C (=Σ. 318).

	°	″			
1881.668	236.9	13.96	...9.0	III	23:30
.695	237.7	14.08	...9.5	II	22:45

There is no change in the distant companion.
The following are the only other measures of the close pair:

	°	″	
1878.66	338.7	0.34	β. 3 nights.
1880.13	323.1	0.29	β. 4 nights.

OΣ. (App.) 31. (7.8 and 8.1.)

R. A. 2h 51m 36s.
Decl. +59° 11′.

	°	″			
1881.647	229.3	74.14	....	I	21:55
.652	229.5	74.06	8.0..8.3	I	20:15
.660	229.4	73.64	7.8..8.3	II	21:40
.663	229.5	73.13	7.7..8.0	I	20:45
.666	229.1	73.78	7.8..8.0	I	20:45
.673	229.5	73.49	7.7..7.9	I	20:35

The following are all the measures:

	°	″	
1875.00	229.4	73.60	De. 3 nights.
1881.66	229.4	73.71	β. 6 nights.

Σ. 335. (8.4 and 8.6.)

R. A. 2h 54m 42s.
Decl. +63° 17′.

	°	″			
1881.663	159.6	23.77	8.5..8.7	I	20:50
.678	159.2	23.67	8.3..8.5	I	21:15
.092	159.6	23.43	8.3..8.5	I	20:35

No other recent measures. Change in distance?

	°	″	
1831.52	158.5	24.38	Σ. 2 nights.
1881.67	159.5	23.62	β. 3 nights.

Σ. 374. (7.9 and 8.7.)

R. A. 3h 13m 11s.
Decl. +67° 2′.

	°	″	
1881.673	294.8	11.31	8.0..9.0
.692	296.1	10.98	8.0..8.7
.695	295.7	11.17	7.7..8.5

No measures since Struve. Relatively fixed.

	°	″	
1831.30	294.7	10.78	Σ. 2 nights.
1881.69	295.5	11.15	β. 3 nights.

Σ. 378. (8.8 and 9.6.)

R. A. 3h 14m 49s.
Decl. +58° 0′.

	°	″			
1881.673	313.3	18.79	8.8..10.0	I	22:30
.692	315.3	19.01	9.0.. 9.7	I	20:50
.695	314.7	18.95	8.6. 9.0	I	20:50

No measures since Struve. Apparently unchanged.

	°	″	
1830.72	313.2	18.59	Σ. 3 nights.
1881.69	314.6	18.92	β. 3 nights.

OΣ. (App.) 36. (6.7 and 7.7.)

R. A. 3h 29m 26s.
Decl. +63° 29′.

	°	″			
1881.673	70.1	46.21	6.7..7.5	I	22:35
.692	70.0	46.24	6.7..8.0	I	20:55
.695	70.2	45.84	6.8..7.5	I	20:35

The following are all the measures:

	°	″	
1873.82	69.9	45.88	De. 1 night.
1881.69	70.1	46.10	β. 3 nights.

Σ. 421. (7.3 and 10.5.)

R. A. 3h 33m 32s.
Decl. +71° 14′.

	°	″			
1881.673	234.7	12.32	7.0..10.5	I	22:40
.692	234.7	12.27	7.5..10.5	I	21:05
.695	233.2	13.00	7.5..10.5	II	20:25

Probably unchanged. No other measures since Struve.

	°	″	
1829.28	235.1	12.40	Σ. 2 nights.
1881.69	234.2	12.53	β. 3 nights.

Σ. 1380. (7.8 and 10.5.)

R. A. 9h 44m 26s.
Decl. +80° 57′.

	°	″			
1881.280	25.8	1.85	7.5..10.5	II	13:25
.304	28.8	1.71	8.0..10.5	II	10:50
.529	29.4	1.78	8.0..10.5	I	18:15

No other recent measures. Without change.

	°	″		
1833.53	29.0	1.70	Σ. 3 nights.	7.6..10.7
1881.37	28.0	1.78	β. 3 nights.	7.8..10.5

8 Sextantis. A. C. 5.

R. A. 9h 46m 35s.
Decl. −7° 32′.

A rapid binary system. The distance has been gradually decreasing from 0″.5 in 1854, when it was discovered by Alvan Clark; and in 1879 it was apparently single with 18½-inch aperture. No elongation could be detected (1881.342) with the highest powers.

Σ. 1457. (7.8 and 8.3.)

R. A. 10h 32m 28h.
Decl. +6° 21′.

	°	″			
1881.258	317.1	1.23	8.0..8.5	III	9:10
.359	317.3	0.96	8.0..8.4	IV	12:20 cloudy.
.386	312.0	1.02	7.5..8.0	III	12:45

A few of the measures of this binary will be sufficient to indicate the relative motion.

	°	″	
1829.55	287.8	0.71	Σ. 4 nights.
1840.29	302.0	0.79	OΣ. 3 nights.
1875.39	312.0	1.18	Shp. 4 nights.
1881.33	314.1	1.07	β. 3 nights.

H. 2562.

R. A. 11h 4m 12s.
Decl. +31° 49′.

	°	″			
1881.364	327.6	1.24	9.0..10.5	II	13:10

The only prior observation is that of Herschel, who gives the angle 347.2°, and estimated distance 1.5″.

ψ Leonis. Sh. 121.

R. A. 11h 10m 34s.
Decl. −3° 0′.

	°	″			
1881.356	287.9	101.38	....	I	11:00
.359	287.9	101.28	5. ..8.5	II	12:40
.364	288.0	101.41	....	II	11:35

No other measures since 1821.

	°	″	
1821.28	286.9	106.25	Sh. 1 night.
1881.36	287.9	101.36	β. 3 nights.

ξ Ursæ Majoris. Σ. 1523.

R. A. 11h 11m 48s.
Decl. +32° 13′.

	°	″			
1881.258	269.8	....	....	..	
.386	268.6	1.62	....	IV	11:30
.389	270.8	1.71	....	III	11:35
.395	270.0	1.64	....	III	11:40
1881.35	269.7	1.66			

The last three measures were made by daylight.

Σ. 1533. (8.5 and 8.5.)

R. A. 11h 15m 36s.
Decl. +37° 45′.

	°	″			
1881.364	173.1	23.06	8.5..8.5	I	12:40
.419	172.5	23.17	8.5..8.5	I	14:55

No other measures since Struve. Relatively fixed.

	°	″	
1829.53	172.8	23.14	Σ. 4 nights.
1881.39	172.8	23.16	β. 2 nights.

Σ. 3070. (8.7 and 8.9.)

R. A. 11h 18m 23s.
Decl. −3° 43′.

	°	″			
1881.364	276.5	8.53	8.7..8.8	I	12:25
.367	276.1	8.15	9.0..9.2	II	12:05
.419	277.5	8.49	8.5..8.6	I	13:50

No other recent measures.

	°	″	
1831.26	276.3	7.96	Σ. 3 nights.
1881.38	276.4	8.39	β. 3 nights.

81 Leonis. *H.* V. 61=H. 4433.

R. A. 11h 19m 21s.
Decl. +17° 8′.

	°	″			
1881.359	345.6	57.19	6. ..10.	II	12:00
.364	345.4	57.30	..10.5	II	11:55

There are no other complete measures for comparison. There may be some error in the angle of H.

	°	″	
1783.10	.....	57.28	*H.* 1 night.
1836.21	316.7	60.±	H. 1 night.
1881.36	345.5	57.25	β. 2 nights.

$O\Sigma$. 235. (6.9 and 8.5.)

R. A. 11h 25m 31s.
Decl. +61° 45′.

	°	″	
1881.381	61.4	0.99	7.0..9.0
.383	61.1	0.85	6.8..8.0

An interesting binary, revolving in a period, according to Doberck, of 94.4 years. Some of the mean results are:

	°	″	
1844.90	293.0	0.60	$O\Sigma$. 2 nights.
1851.42	327.9	0.54	$O\Sigma$. 2 nights.
1861.74	15.6	0.69	$O\Sigma$. 3 nights.
1877.26	55.5	1.07	De. 2 nights.
1881.38	61.2	0.92	β. 2 nights.

Sh. 132.

R. A. 11h 46m 35s.
Decl. +16° 6′.

	°	″			
1881.364	13.8	39.07	6.8.. 9.0	I	12:55
1823.30	11.1	37.11	7....10..	Sh.	

Σ. 3123. (7.2 and 7.5.)

R. A. 12h 0m 0s.
Decl. +69° 22′.

	°	″			
1881.381	220.6	0.34	7.0..7.5	IV	12:15
.383	223.2	0.29	7.5..7.5	IV	12:15

A very difficult pair, of which there but few measures. It was noted as single or very doubtful elongation by De. and OΣ., 1851–68.

	°	″	
1832.20	289.7	0.3	Σ. 4 nights.
1881.38	221.9	0.32	β. 2 nights.

Corvus 22. β—.

R. A. 12h 11m 42s.
Decl. −23° 21′.

	°	″			
1879.373	217.9	2.92	7.0..10.8	II	12:15
79.375	220.0	3.05	7.5..12 0	II	12:46
81.334	218.0	2.88	6.5..11.5	II	12:15
81.342	217.6	3.63	6.5..11.0	II	12:00
81.353	218.8	3.02	7.5..10.5	I	13:15
1880.55	218.5	3.10	7.5..11.6		

One of the unpublished Chicago pairs. The first two measures, made at the time of finding this pair, are combined with the more recent observations.

S. 637. (8.1 and 8.6.)

R. A. 12h 20m 59s.
Decl. −19° 18′.

	°	″			
1881.367	203.0	60.77	8.3..9.0	II	12:20
.389	202.6	60.53	8.0..8.4	I	13:20
.416	202.8	60.61	8.0..8.5	I	13:10

But little, if any, change. The following are all the measures:

	°	″	
1825.35	203.1	61.63	S. 3 nights.
1881.39	202.8	60.64	β. 3 nights.

31 Virginis. β—. (5.8 and 11.6.)

R. A. 12h 35m 53s.
Decl. +7° 28′.

	°	″			
1879.331	26.9	3.80	5.8..11.5	II	12:45
79.337	31.1	3.52	5.5..11.8	II	12:12
79.342	28.0	3.35	6.0..12.0	II	11:00
81.304	30.1	3.91	5.5..11.0	III	12:50
81.386	29 0	3.71	6.0..11.5	II	13:10
1880.14	29.0	3.66			

Discovered at Chicago in 1879, and not yet catalogued as a double star. The first three measures above were made with the 18½-inch.

O. Arg. 12501. Stone. (7.6 and 9.5.)

R. A. 12h 47m 25s.
Decl. −28° 40′.

	°	″			
1881.334	31.5	3.15	7.0..10.0	I	12:45
.342	31.3	3.03	7.7.. 9.0	II	12:15
.356	31.8	2.79	8.0.. 9.5	I	13:25

Discovered by O. Stone at Cincinnati.

	°	″	
1877.33	30.5	3.04	Cin. 2 nights.
1881.34	31.5	2.99	β. 3 nights.

Σ. 1695. (7.0 and 8.5.)

R. A. 12h 51m 3s.
Decl. +54° 45′.

	°	″			
1881.288	287.0	3.43	7.0..8.5	III	11:00
1832.13	289.1	3.26	Σ. 3 nights.		

Hydræ 348. β. 341. (6.2 and 6.2.)

R. A. 12h 57m 19s.
Decl. −19° 56′.

	°	″			
1881.419	133.2	0.78	6.0..6.0	II	12:45
.496	133.7	0.64	6.5..6.5	III	14:30

The following are all the measures:

1876.30	136.4	0.78	De. 2 nights.
1877.37	134.4	1.00	Os. 4 nights.
1881.46	133.4	0.71	β. 2 nights.

48 Virginis. β. —. (6.0 and 6.0.)

R. A. 12h 57m 43s.
Decl. −3° 5′.

	°	″			
1879.373	230.4	0.25	6.5..6.5	IV	12:58
79.408	228.5	0.74	....	V	13:20
79.416	229.2	0.47	6.0..6.0	V	13:10
81.438	223.2	0.47	6.0..6.0	III	13:20
81.447	232.4	0.54	6.0 :6.0	III	14:10
81.496	225.3	0.43	6.0..6.0	IV	14:40
1880.43	228.2	0.48			

An unpublished new star, the Chicago measures of which are given above.

42 Comae. Σ. 1728.

R. A. 13h 4m 10s.
Decl. +18° 10′.

	°	″			
1881.353	193.3	0.62	....	IV	13:35
.370	192.8	0.65	....	IV	12:30
.386	192.3	0.62	....	IV	11:40
.389	193.8	0.65	....	IV	11:40
1881.37	193.0	0.64			

A well-known binary system, with a period of only 25.7 years.

Sh. 162. (7.0 and 8.0.)

R. A. 13h 8m 37s.
Decl. — 10° 43′.

	°	″			
1881.353	52.8	64.70	7.0..8.0	II	12:40
.356	52.0	64.48	7.0..8.0	I	12:45
.392	52.8	64.62	7.0..8.0	IV	12:35

The above are the only measures since South and Herschel. The principal star has a proper motion of 0″.372 in the direction of 219°.7, which substantially accounts for the change since 1823.

	°	″	
1823.34	61.7	44.85	Sh. 1 night.
1881.37	52.5	64.60	β. 3 nights.

$O\Sigma$. 267. (7.7 and 8.0.)

R. A. 13h 23m 9s.
Decl. +76° 37′.

	°	″			
1881.318	305.9	0.35	7.5..8.0	IV	10:20
.381	307.2	0.31	8.0..8.0	IV	12:00

A difficult double star, noted as single by De. in 1866.
The following are all the measures. Probably unchanged, and the observation of Mädler erroneous.

	°	″	
1849.60	300.8	0.25	$O\Sigma$. 3 nights.
1852.70	12.0	0.5	Ma. 2 nights.
1881.35	306.5	0.33	β. 2 nights.

Sh. 165. (7.0 and 7.7.)

R. A. 13h 26m 3s.
Decl. — 12° 3′.

	°	″			
1881.419	80.4	48.01	6.5..7.5	II	13:00
.447	78.6	48.01	7.5..8.0	II	14:00

The following are all the measures. Probably fixed.

	°	″	
1783.26	....	41.80	*H*. 1 night.
1823.29	78.8	47.72	Sh. 1 night.
1881.43	79.5	48.01	β. 2 nights.

$O\Sigma$. 269.

R. A. 13h 27m 26s.
Decl. +35° 32′.

1881.419	Apparently single.	IV	.....
.433	Round.	IV	12:40

A rapid binary, but now single, or less than 0″.2 in distance. The motion, according to the Pulkowa observations, was about 40° from 1844 to 1872. The distance has never exceeded 0″.3.

Virginis 550. β. —.

R. A. 13h 28m 28s.
Decl. —12° 36′.

	°	″			
1881.342	86.3	0.50	6.0..7.0	III	13:00
.370	84.1	0.55	6.0..7.0	IV	12:45
.392	84.3	0.47	6.0..6.5	IV	12:15

This star was noted as variable, 5 to 8 magnitude, by Schmidt in 1866, and found to be a close double with the Chicago 18½ inch in 1879. No change in magnitude has been detected in making the measures. The two sets of measures are:

	°	″		
1879.39	81.3	0.47	6.1..6.6	β. 4 nights.
1881.37	84.9	0.51	6.0..6.8	β. 3 nights.

25 Canes Ven. Σ. 1768. (5.5 and 7.8.)

R. A. 13h 32m 7s.
Decl. +36° 54′.

	°	″			
1881.419	156.8	0.41	5.5..7.5	IV	12:40
.433	157.5	0.41	..8.0	IV	12:25
.436	153.4	0.40	..8.0	IV	12:35
1881.43	155.9	0.41			

A well-known binary, for which Doberck (1877) gives a period of 124.5 years. The last two measures were made before sunset.

86 Virginis. β. —.

R. A. 13h 29m 33s.
Decl. —11° 49′.

A and B.

	°	″			
1881.438	295.7	1.11	6.0..10.5	II	13:20
.447	296.5	1.45	.. 9.0	III	13:50

Discovered at Chicago, 1879. The Struve companion is also double.

	°	″	
1879.37	298.4	1.61	β. 5 nights.
1881.44	296.1	1.33	β. 2 nights.

τ. Bootis. $O\Sigma$. 270. (5 and 11.3.)

R. A. 13h 41m 35s.
Decl. +18° 3′.

	°	″			
1881.419	355.9	8.78	5....12..	II	14:00
.502	355.3	8.90	..11..	II	15:20
.504	351.6	9.03	..11..	I	15:40

A physical pair, the components having a common proper motion. The relative change will be seen from the following:

	°	″	
1849.54	347.8	10.26	$O\Sigma$. 5 nights.
1867.36	348.9	9.04	De. 3 nights.
1878.31	351.9	8.71	β. 4 nights.
1881.47	354.3	8.90	β. 3 nights.

Σ. 1807. (8.0 and 8.1.)

R. A. 14h 5m 6s.
Decl. −2° 46′.

	°	″			
1881.320	27.7	6.98	8.0..8.2	II	15:00
.329	30.1	7.53	8.0..8.0	I	14:00
.331	28.7	7.12	8.0..8.1	II	13:05

Probably unchanged.

	°	″	
1831.01	25.8	7.08	Σ 3 nights.
1879.30	27.4	7.05	Cin. 3 nights.
1881.33	28.8	7.21	β. 3 nights.

ι. Bootis.

R. A. 14h 11m 56s.
Decl. +51° 55′.

1881.381 Certainly single. IV 12:40

The principal star of this wide pair was supposed by Σ. at one time to be a close double, but it has always appeared single with all modern large apertures, and the elongation suspected by Σ. is doubtless a mistake.

$O\Sigma$. 282. (7.5 and 11.5.)

R. A. 14h 20m 5s.
Decl. +7° 46′.

	°	″			
1881.329	215.0	23.23	....	II	12:30
.340	215.0	23.47	7.5..11.5	II	12:45

An uninteresting pair, and probably fixed.

	°	″	
1867.40	215.8	22.92	De. 3 nights.
1881.33	215.0	23.35	β. 2 nights.

B. A. C. 4885. $O\Sigma$. 285.

R. A. 14h 40m 59s.
Decl. +42° 53′.

1881.502	Round, or doubtful elongation.	IV	15:40

In rapid motion, and certainly binary.

	°	″	
1845.80	72.2	0.61	$O\Sigma$. 3 nights.
55.84	53.9	0.51	$O\Sigma$. 3 nights.
65.58	uncertain elongation in 36°		De. 1 night.

P. XIV. 212. Sh. 190. (6.5 and 7.9.)

R. A. 14h 50m 27s.
Decl. −20° 52′.

	°	″				
1881.342	291.5	15.35	6.0..8.0	II	13:15	
.356	291.4	15.54	6.8..8.0	II	13:40	
.367	292.7	15.31	6.5..7.5	II	13:05	bright wires.
.367	290.9	15.32	....	II	13:10	bright field.
.370	290.0	15.37	6.7..8.0	III	14:55	
1881.36	291.3	15.38				

A remarkable system from the large proper motion of both components, resembling 61 Cygni. According to Argelander the principal star is moving at the rate of 2″.015 per year in the direction of 151°.2. Some of the measures are:

	°	″	
1823.32	270.1	10.82	Sh. 1 night.
1836.66	277.4	12.08	H. 1 night.
1878.36	290.8	15.33	β. 4 nights.
1881.36	291.3	15.38	β. 4 nights.

59 Hydræ. β. 239. (6.0 and 6.0.)

R. A. 14h 51m 33s.
Decl. — 27° 10′.

	°	″				
1881.370	135.0	1.19	6.0..6.0	II	14:55	
.375	125.3	1.00	.....	IV	15:20	unsteady.
.397	133.7	1.08	6.0..6.0	II	15:45	
.433	133.8	1.02	6.0..6.0	III	15:05	

A difficult pair from its low altitude. The measures seem to point to some motion.

	°	″	
1874.50	123.7	0.8±	β. 5 nights.
1880.38	127.4	0.90	Cin. 4 nights.
1881.40	132.0	1.07	β. 4 nights.

2 Serpentis. β. 348. (6.0 and 7. 8.)

R. A. 14h 55m 40s.
Decl. +0° 20′.

	°	″			
1881.370	119.8	0.42	6.0..8.0	IV	15:15
.414	118.5	0.53	6.0..8.0	IV	15:45
.433	120.7	0.41	6.0..7.5	IV	13:00 daylight.

A close pair found with the 6-inch in 1875. The following are the principal measures.

	°	″		
1875.75	114.5	0.45	De.	4 nights.
1876.50	119.0	0.5	Shp.	4 nights.
1881.41	119.7	0.45	β.	3 nights.

Σ. 1902. (8.2 and 8.3.)

R. A. 14h 56m 16s.
Decl. +16° 16′.

	°	″			
1881.364	187.8	26.26	8.2..8.2	I	14:15
.386	187.3	26.19	8.3..8.5	II	13:20
.504	187.2	25.98	8.0..8.2	II	16:00

No measure since Struve. Probably unchanged.

	°	″		
1828.80	185.5	25.75	Σ.	2 nights.
1881.42	187.4	26.14	β.	3 nights.

Σ. 1928. (8.6 and 8.8.)

R. A. 15h 9m 27s.
Decl. +72° 54′.

	°	″			
1881.468	276.4	6.48	8.7..9.0	I	16:20
.490	278.3	6.94	8.5..8.7	I	16:20
.493	277.1	6.68	8.5..8.6	I	15:50

These stars are evidently fixed relatively.

	°	″		
1832.27	277.6	6.58	Σ.	4 nights.
1881.48	277.8	6.70	β.	3 nights.

Σ. 3091.

R. A. 15h 9m 43s.
Decl. −4° 26′.

This pair has now become a very difficult object to measure; not seen by Hl. with 26-inch, 1875. The following are the principal measures. There seems to be but little change in the angle:

	°	″			
1832.39	47.3	0.50	Σ.	6 nights.	7.7..7.7
1879.30	42.4	0.4 ±	Cin.	2 nights.	
1878.36	45.0	0.25 ±	β.	1 night.	
1881.50	47.5	0.30	β.	1 night.	8.0..8.2

β. 253. (9.3 and 9.4.)

R. A. 15h 13m 55s.
Decl. +85° 57′.

	°	″			
1881.468	298.5	3.22	9.0..9.1	I	16:30
.490	294.0	4.09	9.5..9.7	I	16:10
.493	298.4	3.48	9.3..9.5	I	15:40
1881.48	297.0	3.60			

There are no earlier measures of this pair.

ν. Coronæ. Σ. 1937.

R. A. 15h 18m 14s.
Decl. +30° 43′.

	°	″			
1881.274	124.4	0.55	....	IV	12:09
.309	123.0	0.51	....	IV	.....
.329	126.4	....	....	II	14:15
.331	126.1	0.47	....	IV	14:35
.373	121.7	0.51	....	IV	18:30

The mean results of these and other late measures are:

	°	″	
1879.54	98.7	0.48	Hl. 4 nights.
1880.62	114.3	0.46	β. 5 nights.
1881.32	124.3	0.51	β. 5 nights.

μ. Bootis. Σ. 1938.

R. A. 15h 20m 0s.
Decl. +37° 46′.

	°	″			
1881.274	126.9	0.76	....	IV	13:30
.373	125.7	0.68	....	IV	17:35
.433	125.9	0.58	....	IV	13:15
.436	121.4	0.49	....	IV	12:00 daylight.

Some of the recent measures of this well-known binary are:

	°	″	
1876.44	145.4	0.73	Hl. 4 nights.
1879.54	133.3	0.73	Hl. 4 nights.
1880.18	128.7	0.78	β. 5 nights.
1881.38	125.0	0.63	β. 4 nights.

Sh. 202. (7.2 and 7.5.)

R. A. 15h 21m 40s.
Decl. —8° 55′.

	°	″			
1881.367	133.8	52.27	7.5..7.7	II	14:00
.370	133.9	52.06	7.0..7.3	II	15:35
.436	133.7	52.13	7.0..7.5	I	15:50

The double star, *H* V. 27, is undoubtedly identical with this, but Herschel's R. A. is about 6m too small, and the Decl. should be increased about half a degree. There is no pair in Herschel's place. His measure, given below, evidently belongs to this pair. The change is due to the proper motion of the principal star, which Argelander gives as 0″.342 in the direction of 164°.4.

	°	″	
1782.36	130.3	44.42	*H.* 1 night.
1823.44	134.6	51.76	Sh. 3 nights.
1881.39	133.8	52.15	*β.* 3 nights.

$O\Sigma$. 298. (7.8 and 7.9.)

R. A. 15h 31m 42s.
Decl. +40° 13′.

	°	″			
1881.373	355.4	0.31	7.8..8.0	IV	17:45
.383	345.8	0.33	7.5..7.5	IV	14:10
.502	349.7	0.43	8.0..8.1	IV	15:50

A rapid binary and now close and difficult.

	°	″	
1846.49	181.6	1.20	$O\Sigma$. 3 nights.
1866.44	208.9	0.99	De. 4 nights.
1877.44	295.2	0.3±	De. 2 nights.
1878.33	310.7	0.27	*β.* 2 nights.
1879.46	335.0	0.26	Hl. 4 nights.
1881.42	350.3	0.36	*β.* 3 nights.

γ. Coronæ. Σ. 1967.

R. A. 15h 37m 42s.
Decl. +26° 41′.

1881.433	Single.	IV	13:05
.502	Round, or doubtful elongation.	IV	16:25

One of the most interesting binaries. Doberck (1877) finds the period to be 95.5 years. It has been apparently single with all apertures since about 1871.

$\pi.^2$ Ursæ Minoris. Σ. 1989. (6.5 and 7.3.)

R. A. 15h 46m 13s.
Decl. +80° 22′.

	°	″			
1881.381	14.2	0.5±	....	IV	12:50
.383	18.5	0.41	6.5..7.5	IV	11:50
.436	13.2	0.56	6.5..7.0	III	13:40
.468	13.6	0.50	6.5..7.5	IV	13:50

There are but few measures of this pair since Struve. There is but little, if any, change.

	°	″	
1836.76	23.9	0 53	Σ. 3 nights.
1840.90	28.1	0.70	$O\Sigma$. 3 nights.
1881.43	14.9	0.49	*β.* 4 nights.

ε. Coronæ. A. G. C. 7.

R. A. 15h 52m 37s.
Decl. +27° 14′.

	°	″			
1881.433	361.1	2.16	..11	IV	13.30
.499	359.2	2.33	..10.5	IV	.....

A very unequal pair, discovered by Alvan G. Clark. The following are all the measures:

	°	″	
1877.62	352.7	2.17	Hl. 6 nights.
1878.36	360.2	1.86	β. 2 nights.
1881.47	360.1	2.24	β. 2 nights.

β. Scorpii. (AB. = β.—; AC. = *H.* III 7.)

R. A. 15h 58m 28s.
Decl. −19° 29′.

A and B.

	°	″			
1881.340	93.8	0.87	..10	IV	15:55
.578	90.3	1.03	.. 9	IV	16:25
.581	93.9	0.97	.. 9	IV	17:20

A and C.

.578	24.8	13.51	....	IV	16:30
.581	25.7	13.44	....	III	16:50
.608	25.1	13.28	....	II	17:55

The close star, B, was discovered with the Chicago 18½-inch, and is not yet numbered in the last series of new pairs. It is a difficult object, and requires a high power and favorable conditions to be satisfactorily observed. The only measures of this star are:

	°	″		
1880.06	88.4	0.91	β. 6 nights.	B=9.7m.
1881.50	92.7	0.96	β. 3 nights.	9.3

There is no material change in the Herschel companion:

	°	″	
1823.28	26.5	13.65	Sh. 2 nights.
1868.56	25.5	13.71	De. 4 nights.
1881.59	25.2	13.41	β. 3 nights.

Σ. 2009. (8.5 and 9.1.)

R. A. 15h 59m 58s.
Decl. +60° 49′.

	°	″			
1881.499	303.2	17.16	8.5..9.0	I	16:15
.504	303.2	17.73	8 5..9.2	I	19:00
.622	304.1	17.60	8.6..9.0	II	18:30

No other recent measures. There is but little change since Struve.

	°	″	
1830.22	304.6	16.94	Σ. 2 nights.
1881.54	303.5	17.50	β. 3 nights.

ν. Scorpii. AB=β. 120. (4.3, 6.7, 7.0 and 8.0.)

R. A. 16h 5m 1s.
Decl. −19° 9′.

A and B.

	°	″			
1881.340	4.8	0.75	....	III	15:40
.342	6.2	0.87	....	III	15:10
.375	5.4	0.97	....	III	15:15
.496	10.6	0.91	....	III	16:00
.578	6.7	0.70	....	IV	16:35
.581	7.8	0.64	....	IV	17:15

C and D.

	°	″			
1881·578	44.9	2.06	7.0..8.0	IV	16:40
.581	47.8	1.96	....	III	17:00
.608	46.1	2.07	....	II	17:40

A and C.

	°	″			
1881.581	336.9	40.68	....	III	17:05
.608	336.5	41.25	....	II	17:45
.610	336.3	40.99	....	II	17:15

One of the most interesting quadruple systems. There is but little change in CD, but the distance of AB is slowly increasing. Some of the measures are as follows:

A and B.

	°	″	
1874.40	357.7	....	β. 6 nights.
1875.94	359.9	0.73	De. 11 nights.
1879.03	360.2	0.74	Cin. 5 nights.
1880.00	366.2	0.66	β. 8 nights.
1881.45	366.7	0.81	β. 6 nights.

C and D.

	°	″	
1847.4	42.2	1.8±	J.
1875.42	47.9	1.89	De. 4 nights.
1879.41	45.2	2.07	Cin. 9 nights.
1881.59	46.3	2.03	β. 3 nights.

A and C.

	°	″	
1821.4	338.2	40.82	Sh. 1 night.
1875.43	336.5	40 77	De. 4 nights.
1881.60	336.6	40.97	β. 3 nights.

Σ. 2075.

R. A. 16h 28m 7s.
Decl. +80° 19′.

	°	″			
1881.285	323.3	1.48	...	III	9:40
.304	321.9	1.19	8·5..10.8	II	10:40

No other measures since Struve, There is evidently some angular motion.

	°	″	
1833.25	309.9	1.17	Σ. 3 nights.
1881.29	322.6	1.28	β. 2 nights.

$O\Sigma$. 313. (8.0 and 8.1.)

R. A. 16h 28m 30s.
Decl. +40° 22′.

	°	″			
1881.304	150.9	0.84	8.0..8.3	III	11:40
.383	151.6	0.77	8.0: 8.1	IV	13:30
.395	151.3	1.01	7.8..8.0	III	13:55

Probably in slow retrograde motion.

	°	″	
1847.47	162.2	0.80	$O\Sigma$. 5 nights.
1866.76	153.8	0.92	De. 4 nights.
1881.36	151.3	0.87	β. 3 nights.

Σ. 2062. (8.5 and 9.6.)

R. A. 16h 28m 42s.
Decl. +8° 56′.

	°	″			
1881.386	113.7	2.22	8.5..9.7	II	17:30
.608	115.4	2.24	8.6..9.5	I	18:15

Little or no change. The companion was not seen by De. in 1865.

	°	″	
1832.14	112.9	2.30	Σ. 3 nights.
1881.49	114.5	2.23	β. 2 nights.

ξ. Herculis. Σ. 2084.

R. A. 16h 36m 47s.
Decl. +31° 49′.

	°	″			
1881.436	111.0	1.29	....	IV	12:00
.452	113.2	1.63	....	IV	14:30
.455	109.8	1.78	....	IV	14:50
.458	110.4	1.45	....	IV	13:50
.465	108.6	1.51	....	IV	13:40
1881.45	110.6	1.53			

The last four measures made by daylight.

H. V. 127. (7.3 and 8.0.)

R. A. 16h 37m 48s.
Decl. +6° 51′.

	°	″			
1881.364	291.7	53.65	7.0..8.0	II	14:40
.386	292.0	53.17	7.5..8.0	I	17:10
.389	291.9	53.11	7.5..8.0	I	16:30

The following are all the measures:

1783.65	289.7	48.67	*H.* 1 night.
1823.42	291.0	54.31	Sh. 7 nights.
1881.38	291.9	53.31	β. 3 nights.

Σ. 2099. (8.7 and 10.8.)

R. A. 16h 39m 15s.
Decl. +70° 35′.

	°	″			
1881.460	218.0	9.53	8.8..10.5	I	16:45
.468	219.2	9.55	8.7..10.8	I	16:35
.493	219.6	9.82	8.5..11.0	I	16:00

No other measures since Struve.

	°	″	
1832.27	218.9	9.45	Σ. 2 nights.
1881.48	218.9	9.63	β. 3 nights.

De. 15. (8.3 and 8.3.)

R. A. 16h 40m 12s.
Decl. +43° 42′.

	°	″			
1881.373	285.0	0.60	8.3..8.3	IV	18:10
.433	286.5	1.44	8.0..8.2	IV	14:20
.447	283.2	0.35	8.5..8.5	IV	15:50

Discovered by Dembowski in 1869. The measures show rapid motion.

	°	″	
1870.44	131.7	0.93	De. 5 nights.
1876.54	118.1	0.64	De.
1881.42	104.9	0.46	β. 3 nights.

21 Ophiuchi. *O*Σ. 315.

R. A. 16h 45m 19s.
Decl. +1° 25′.

	°	″			
1881.578	166.3	0.89	5.0..7.0	IV	16:15
.608	166.5	1.04	5.5..7.0	II	18:10

Slow angular motion and undoubtedly binary.

	°	″	
1844.59	173.0	0.87	*O*Σ. 2 nights.
1876.59	165.7	0.98	Shp. 5 nights.
1881.59	166.4	0.97	β. 2 nights.

Ophiuchi 74. β. 241. (6.7 and 6.8.)

R. A. 16h 48m 24s.
Decl. −21° 22′.

	°	″			
1881.496	346.6	0.83	7.0..7.0	III	16:30
.578	342.8	0.47	6.3..6.5	IV	16:55
.581	339.5	0.65	6.8..6.9	IV	17:30

The observations are not sufficient to decide as to motion.

	°	″	
1879.06	159.6	0.63	Cin. 5 nights.
1881.55	343.0	0.65	β. 3 nights.

20 Draconis. Σ. 2118.

R. A. 16h 55m 49s.
Decl. +65° 13′.

	°	″			
1881.493	204.5	0.2±	......	IV	16:20
.545	213.6	0.2±	....	IV	16:20

This is now one of the most difficult double stars. The angles given above are somewhat uncertain. There are but few late measures:

	°	″	
1832.30	246.4	0.85	Σ. 5 nights.
1859.67	235.7	0.58	OΣ. 2 nights.
1880.11	213.7	0.23	β. 2 nights.
1881.52	209.0	0.2±	β. 2 nights.

Herculis 206. (Perry.) (6.9 and 10.2.)

R. A. 16h 59m 26s.
Decl. +19° 46′.

	°	″			
1881.502	235.8	1.81	7.0.. 9.3	III	19:10
.507	231.0	1.66	6.8..10.0	III	16:25
.556	......	1.79	7.0..10.5	III	18:45
.562	230.1	1.94	6.7..10.5	III	18:45
.578	233.5	1.69	7.0..10.5	III	19:40
1881.54	232.5	1.78			

Discovered in 1881 by Rev. J. J. M. Perry, with 18¼ inch reflector, 1881. In measuring this pair, a new and more difficult pair was found in the same low-power field, 47s *p.* and 5′*n.* The mean result of the measures of this pair is: P=228.°0; D=1.″50, mags. 6.9 and 11.3. (1881.56.)

β. 124.

R. A. 17h 3m 59s.
Decl. −0° 37′.

	°	″			
1881.342	263.9	0.98	7.0..11.0	III	10:30
.507	268.8	0.90	7.0..11.0	III	18:30

Further measures are necessary to decide the question of motion.

	°	″	
1875.11	253.5	1.12	De. 3 nights.
1881.42	266.8	0.94	β. 2 nights.

β. 282. (6.5 and 11.2.)

R. A. 17h 8m 29s.
Decl. −14° 27′.

	°	″			
1881.383	151.6	4.34	6.5..11.0	II	17:30
.389	150.3	4.46	6.5..11.5	II	16:40
.496	153.2	4.42	6.5..11.0	II	16:35
.578	153.8	4.41	6.8..11.0	III	17:10

The principal star was thought by Stone to be very close pair, but on the occasion of the last measure above, when the seeing was remarkably good, it was found to be perfectly round with the highest powers.

	°	″	
1875.41	154.1	4.23	De. 3 nights.
1881.42	151.7	4.41	β. 4 nights.

Lac. 7312. (Howe.) (7.2, 10.2 and 9.2.)

R. A. 17h 22m 42s.
Decl. −33° 27′.

A and B.

	°	″			
1881.433	327.2	4.80	7.0..10.5	I	17:17
.436	326.0	4.36	7.5..10.0	I	17:50
.447	321.0	4.80	7.0..10.0	I	18:00
1881.44	324.7	4.65			

A and C.

	°	″			
1881.433	29.5	58.92	..9.0	I	17:25
.436	29.3	58.56	..9.5	I	17:55
1881.43	29.4	58.74			

Ophiuchi 221. Σ. 2173. (6.3 and 6.4.)

R. A. 17h 24m 14s.
Decl. −0° 58′.

	°	″			
1881.383	115.9	0.26	6.5. 6.5	IV	17:50
.578	114.3	0.22	6.5..6.5	IV	17:00
.581	114.5	0.24	6.0..6.2	IV	17:35

A fine binary system, and rapidly closing. Duner finds a period of 45.4 years. Some of the late measures are:

	°	″	
1870.84	156.2	0.87	De. 10 nights.
1876.52	149.3	0.77	Hl. 3 nights.
1879.22	137.0	0.69	Cin. 16 nights.
1880.47	131.3	0.36	β. 1 night.
1881.51	114.9	0.24	β. 3 nights.

Duner gives the following ephemeris:

	°	″
1878.43	142.1	0.62
1880.43	131.8	0.40
1882.43	97.1	0.20
1884.43	21.8	0.25
1886.43	353.1	0.46
1888.43	344.8	0.68
1890.43	340.4	0.87

26 Draconis. β.— (5.8..10.2.)

R. A. 17h 33m 44s
Decl. +61° 58′.

	°	″			
1881.455	145.4	1.44	6.5..10.0	III	15:30
.493	149.9	1.37	5.0..10.5	III	15:10
.540	.....	1.18	....	IV	16:00
.652	148.9	1.26	6.0..10.0	IV	18:35

One of the unpublished Chicago stars. Argelander gives the principal star an annual proper motion of 0″.582 in the direction of 152.2. The following are all the measures. The stars are evidently physically connected:

	°	″		
1879.97	151.8	1.37	β. 4 nights.	6.0..10.2
1881.53	148.1	1.31	β. 3 nights.	5.5..10.1

μ. Herculis. BC=A. C. 7.

R. A. 17h 41m 47s.
Decl. +27° 48′.

	°	″			
1881.378	248.4	0.95	....	II	17:20
.388	254.0	0.89	.. .	II	14:20
.395	253.7	0.96	....	III	14:35
.433	253.4	0.96	...	III	14:30
.447	250.9	0.83	....	III	16:00

Some of the late measures of this difficult binary are:

	°	″	
1876.59	223.4	0.72	Hl. 4 nights.
1877.59	232.8	0.85	Hl. 2 nights.
1878.48	234.9	1.05	. 6 nights.
1879.45	242.7	0.90	β. 5 nights.
1880.47	245.9	0.96	β. 7 nights.
1881.41	252.1	0.92	β. 5 nights.

90 Herculis. β. 130. (6.0 and 9.7.)

R. A. 17h 49m 22s.
Decl. +40° 8′.

	°	″			
1881.458	122.8	1.74	6.0.. 9.5	III	14:10
.460	123.7	1.98	6.0..10.0	III	14:35
.465	119.7	1.86	6.0.. 9.5	III	14:20
.471	122.8	2.03	....	III	14:15

The following are all the measures:

	°	″	
1875.52	123.0	1.82	De. 6 nights.
1881.46	122.2	1.90	β. 4 nights.

Σ. 2253. (8.0 and 10.3.)

R. A. 17h 52m 55s.
Decl. +14° 38′.

	°	″			
1881.364	79.8	15.79	8.0..10.0	II	15:25
.370	79.1	16.45	8.0..10.5	II	17:25
.383	80.1	16.20	8.0..10.5	II	18:20

The distance and angle are slowly diminishing, as will be seen from the following:

	°	"	
1829.53	80.4	18.06	Σ. 2 nights.
1863.47	80.2	16.51	De. 2 nights.
1881.37	79.5	16.15	β. 3 nights.

H. No. 40. (7.4, 10.3, 8.2 and 11.2)

R. A. 17h 55m 6s.
Decl. $-23°$ 1′.

A and B.

	°	"			
1881.433	23.6	5.65	7.5..10.0	I	18:20
.496	21.9	6.25	7.7..11 0	II	17:40
.507	21.8	6.03	7.0.. 9.5	II	19:05
1881.48	22.4	5.98			

C and D.

	°	"			
1881.383	278.7	2·01	.....11.0	I	18:00
.496	278.8	2.03	8.5..11.0	II	17:35
.507	282.9	2.15	8.0..11.5	II	19:00
1881.46	280.1	2.06			

A and C.

	°	"			
1878.433	215.4	11.23	....	I	18:15
.496	212.3	10.73	....	II	17:45
.507	212.5	10.83	....	II	19:10
1881.48	213.4	10.93			

A quadruple system in the great trifid nebula. The close star, D, was discovered by Langley. The wide stars, AC, are apparently unchanged since *H.*

β. 243. (8.2 and 8.2.)

R. A. 18h 0m 55s.
Decl. $-22°$ 17′.

	°	"			
1881.578	125.7	0.61	8.0..8.1	III	17:25 very good.
.581	124.0	0.73	8.0..8.0	III	18:00 good.
.586	120.1	0.94	8.5..8.5	II	19:00 poor seeing.

The only measures are the following:

	°	"	
1879.59	125.8	0.83	Cin. 2 nights.
1881.58	123.3	0.76	β. 3 nights.

β. 244. (8.0 and 9.8.)

R. A. 18h 1m 1s.
Decl. —27° 53′.

	°	″				
1881.578	258.1	2.03	8.0..10.0	III	17:35	
.581	258.1	2.10	8.0..10.0	III	18:05	
.600	258.5	1.95	8.0.. 9.5	I	18:40	Unsteady.
1881.59	258.2	2.03				

99 Herculis. A. C. 15.

R. A. 18h 2m 28s.
Decl. +30° 33′.

	°	″			
1881.433	29.4	0.51	6.0..9.5	IV	14:45

This pair was discovered by Mr. Clark in 1859. The distance has diminished so that it is now an excessively difficult object. Flammarion has pointed out that the relative motion corresponds very nearly with the proper motion of the large star, 0″.088 in the direction of 334.° The presumption would be in favor of a physical relation between the components of so close a pair, but the measures of the next few years will settle this question. The following are all the measures to this time:

	°	″	
1859.63	347.1	1.71	Da. 2 nights.
1878.46	24.4	0.99	β. 3 nights.
1880.18	29.9	0.91	β. 3 nights.
1881.43	29.4	0.51	β. 1 night.

B. A. C. 6158. β. 132. (7.3 and 7.3.)

R. A. 18h 4m 7s.
Decl. —19° 52′.

	°	″				
1881.578	55.9	0.68	7.0..7.0	III	17:45	
.581	55.4	0.86	7.3..7.3	III	18:10	
.586	59.7	0.83	7.5..7.5	III	19:20	Unsteady.

The following are all the measures:

	°	″		
1875.05	240.1	0.78	De. 4 nights.	6.8..7.2
1875.90	238.9	0.7±	Shp. 4 nights.	....
1877.41	50.4	....	Cin. 3 nights.	7.2..7.2
1881.58	57.0	0.79	β. 3 nights.	7.3..7.3

β. 246 (8.1 and 8.1.)

R. A. 18h 10m 33s.
Decl. —19° 43′.

	°	″			
1881.578	109.1	0.35	8.0..8.0	IV	17:55
.581	115.1	0.57	8.3..8.3	III	18:20
.616	105.7	0 49	8.0..8.0	III	17:25

A very difficult pair, discovered with the 6-inch in 1874.

	°	″	
1875.53	108.7	0.42	De. 5 nights.
1881.59	110.0	0.47	β. 3 nights.

Σ. 2315. (7.7 and 8.7.)

R. A. 18h 20m 12s.
Decl. +27° 20′.

	°	″			
1881.395	240.0	0.34	7.8 .9.0	IV	14:55
.644	242.0	0.25	7.5..8.5	IV	18:15

A very difficult binary. Some of the measures are as follows:

	°	″		
1830.74	281.1	0.59	Σ.	4 nights.
1841.12	271.4	0.68	OΣ.	4 nights.
1863.73	257.6	0.53	OΣ.	3 nights.
1879.63	239.6	0.31	β.	2 nights.
1881.46	241.0	0.30	β.	2 nights.

φ. Draconis. $O\Sigma$. 353. (5.0 and 7.7.)

R. A. 18h 22m 30s.
Decl. +71° 16′.

	°	″			
1881.493	57.2	0.44	..5..7.0	IV	15:30
.545	59.5	0.44	..5..7.5	IV	17:00
.556	57.4	0.44	..5..8.0	IV	17:30
.562	55.5	0.42	..5..8.0	IV	18:30
.573	57.8	0.43	....	...	18:50
.575	65.0	0.44	..5..8.0	IV	16:35

A close and difficult pair, with but little relative motion thus far.

	°	″		
1856.13	63.6	0.56	OΣ.	6 nights.
1867.73	62.9	....	De.	5 nights.
1878.59	52.2	0.39	Hl.	8 nights.
1880.26	55.7	0.47	β.	3 nights.
1881.55	58.7	0.43	β.	6 nights.

β. 265. (7.7 and 9.3.)

R. A. 18h 44m 38s.
Decl. +11° 23′.

	°	″				
1881.502	229.0	1.09	7.7.. 9.0	III	19:00	
.578	234.8	1.31	7.5.. 9.0	III	19:15	
.714	233.3	1.63	8.0..10.0	II	19:40	Unsteady.

The following are all the measures:

	°	″		
1875.29	235.9	1.46	De.	4 nights.
1877.50	230.5	1.08	Hl	2 nights.
1881.60	232.4	1.34	β.	3 nights.

ζ. Sagittarii.

R. A. 18h 55m 0s.
Decl. −30° 3′.

	°	″			
1881.578	35.0	0.31	....	IV	17:50
.638	37.2	0.25±	....	IV	18:00

' Excessively difficult, and measures uncertain. Probably in rapid motion. The only measures are:

	°	″		
1867.80	260.8	0.48	Newcomb	1 night.
1878.70	84.2	0.42	β.	1 night.
1879.71	54.8	0.3 ±	β.	1 night.
1881.61	36.1	0.31	β.	2 nights.

H. 1364. (9.7 and 9.9.)

R. A. 18h 59m 36s.
Decl. +44° 17′.

	°	″			
1881.395	206.1	3.32	9.5.. 9.5	I	15:15
.455	207.4	2.98	9.8..10.0	I	16.00
.499	207.1	3.48	9.8..10.3	I	16:00

The following are all the observations. Herschel's distance is greatly underestimated:

	°	″		
1828. ±	204.5	1. ±	H. 1 night.	10.11..11
1881.45	206.9	3.26	β. 3 nights.	9.7 .. 9.9

D. M. (32°) 3306. Bird. (8.4 and 8.6.)

R. A. 18h 59m 45s.
Decl. +32° 35′.

	°	″			
1881.364	316.8	2.48	8.5..8.7	II	18:05
.367	315.4	2.37	8.2..8.3	II	20:30
.383	313.8	3.01	8.3..8.5	II	18:35
.386	314.7	2.67	8.5..8.7	II	18:00
1881·38	315.2	2.66			

Discovered by the late Mr. F. Bird of Birmingham, and communicated by Mr. Geo. Hunt. There are no prior measures.

Σ. 2574. (8.1 and 8.3.)

R. A. 19h 39m 5s.
Decl. +62° 3′.

	°	″			
1881.575	142.8	0.45	8.0..8.5	IV	17:00
.630	145.8	0.60	8.3..8.3	III	21:05
.652	142.5	0.60	8.0..8.0	IV	18:20

Moving slowly in angle and distance.

	°	″		
1832.23	129.4	0.96	Σ.	3 nights.
1866.80	141.4	0.6	De.	3 nights.
1881.62	143.7	0.55	β.	3 nights.

B. A. C. 6814. H. 2904. (6.6 and 10.2.)

R. A. 19h 47m 8s.
Decl. −24° 14′.

	°	″			
1881.433	138.2	17.39	6.5..10.5	I	18:40
.602	136.7	17.71	6.5..10.5	I	19:45
.616	137.9	17.41	6.7.. 9.5	I	17:40

A decided change, probably from proper motion.

	°	″	
1834.60	170.6	20. ±	*H.* 1 night.
1875.10	144.7	.....	*β.* 3 nights.
1877.73	141.4	18.30	Cin. 2 nights.
1878.71	140.8	18.39	*β.* 1 night.
1881.55	137.6	17.50	*β.* 3 nights.

H. III. 105. (9.0 and 9.5.)

R. A. 19h 47m 54s.
Decl. +20° 0′.

	°	″			
1881.364	215.0	16.14	8.7..9.3	II	18:05
.386	214.2	16.48	9.0..9.5	II	18:15
.433	215.4	16.32	9.3..9.8	I	19:00

The following are all the measures:

	°	″	
1783.45	219.6	14.48	*H.* 1 night.
1881.39	214.9	16.31	*β.* 3 nights.

β. Aquilæ. *OΣ.* 532. (3–4 and 12.1.)

R. A. 19h 49m 25s.
Decl. +6° 7′.

	°	″			
1881.386	18.4	12.19	..12.5	I	18:55
.433	17.3	12.14	..12.0	I	19:10
.447	16.8	12.22	..11.8	I	19:15
.455	16.2	12.45	..12.0	I	18:40

The two components have a common proper motion, and probably form a physical system.

	°	″	
1852.44	17.1	12.36	*OΣ.* 4 nights.
1868.10	17.8	11.98	De. 4 nights.
1879.66	16.3	12.31	Hl. 4 nights.
1881.43	17.2	12.25	*β.* 4 nights.

H. 910.

R. A. 20h 9m 29s.
Decl. +2° 29′.

A. and B.

	°	″			
1881.455	319.7	13.58	8.0..13.0	I	19:05

A. and C.

	°	"			
1881.455	247.7	27.49	..12.5	I	18:55
.499	250.4	27.19	..13.0	III	21:10

The nearest companion was added at Cincinnati. Herschel did not measure C.

(Alpha[2] Capricorni. AB.=H. 603; BC.=A. G. C. 12.)

R. A. 20h 11m 24s.
Decl. —12° 55′.

A. and B.

	°	"			
1881.496	145.2	7.68	....	II	19:25
.578	147.3	7.66	....	II	18:54
.581	150.2	7.35	....	I	20:25
.602	148.8	7.30	....	I	19:55

B. and C.

1881.496	237.7	0.99	11.0..11.3	II	19:20
.578	238.5	1.03	11.5..12.0	I	18:50

The duplicity of the Herschel companion was detected by Mr. Alvan G. Clark with the 18½-inch, now at Chicago. The following are the principal measures:

	°	"		
1877.93	242.5	1.15	Hl.	4 nights.
1878.52	241.2	1.06	β.	2 nights.
1880.08	239 6	0.96	β.	2 nights.
1881.54	238.1	1.01	β.	2 nights.

Some change is probable with reference to the large star:

1846.70	144 1	6.36	Mh.	13 nights.
1878.55	150.2	7.41	β.	3 nights.
1881.56	147.9	7.66	β.	4 nights.

σ. Capricorni. Sh. 380. (5 and 8.3.)

R. A. 20h 12m 28s.
Decl. —19° 30′.

	°	"			
1881.581	177.2	55.70	5..8.0	I	20:30
.600	177.2	56.07	8.5	II	18:30
.602	177.1	55.66	8.5	II	19:30

The following are all the measures of this wide pair. Some change in angle and distance:

	°	"		
1782.67	175.2	50.12	*H.*	1 night.
1823.69	176.4	53.70	Sh.	1 night.
1881.59	177.2	55.81	β.	3 nights.

P. XX. 113. Smyth. (7.2 and 11.0.)

R. A. 20h 17m 30s.
Decl. +23° 42′.

	°	"			
1881.433	221.7	28.82	7.0..11.0	I	20:10
.447	221.2	28.54	7.0..10.8	I	18:40
.499	222.0	29.13	7.5 :11.0	I	20:30

The only prior measures are found in Smyth's "Cycle," which are erroneous.

	°	"	
1837.88	222.4	45.0	Sm.
1881.46	221.6	28.83	β.

β. 668. (6.5 and 12.4.)

R. A. 20h 25m 49s.
Decl. −10° 16′.

	°	"			
1881.622	24.9	5.09	6.0..12.5	II.	20:30
.644	26.3	4.68	6.8..12.5	I	19:30
.692	26.1	4.90	6.8..12.0	I	19:40
.731	27.2	5.28	6.5..12.5	I	20:35

According to Argelander, the principal star has an annual proper motion of 0.″309 in the direction of 67.°8. The following are all the measures:

	°	"	
1878.63	29.0	4.64	β. 3 nights.
1881 67	26.1	4.99	β. 4 nights.

β. 671.

R. A. 20h 29m 34s.
Decl. +62° 3′.

	°	"			
1881.575	333.2	0.49	8.0..11.5	IV	17:15
1877.57	334.8	0.5±	β. 1 night.		

β. Delphini. β. 151.

R. A. 20h 31m 55s.
Decl. +14° 11′.

A and B.

	°	"			
1881.395	145.0	0.23	....	IV	19:35
.449	151.2	0.28	....	IV	19:45
.493	145.0	0.31	....	IV	18:50
.496	154.1	0.23	....	IV	20:05
.666	143.1	0.25	....	IV	19:45
.747	157.0	0.25	....	IV	20:00
1881.54	149.2	0.26			

AB and C.

	°	"			
1881.395	116 8	27.66	....	III	19:45
.419	115.1	27.77	..12.5	I	20:00
.499	115.7	27.28	..13.0	III	20:45

AB and D. (Σ. 2704).

	°	"			
1881.395	333.4	35.49	....	III	19:40
.414	334.7	35.43	....	II	19:30
.419	334.5	35.52	....	II	19:50

¶ One of the most interesting and rapid binary systems. It is now excessively difficult, but the distance is probably increasing. The change shown by the measures of the Struve companion is due to the proper motion of the large star.

A and B.

	°	″	
1873.60	355±	0.7±	β.
74.66	15.6	0.61	De. 5 nights.
75.65	20.1	0.54	De. 4 nights.
76.66	25.8	0.48	De. 4 nights.
77.79	40.8	0.32	β. 4 nights.
78.65	53.7	0.24	β. 4 nights.
79.57	No certain elongation.		β.
80.68	133.6	0.26	β. 5 nights.
81.50	149.2	0.26	β. 5 nights.

AB and C.

	°	″	
1878.05	116.2	27.66	β. 3 nights.
1880.46	114.7	27.56	β. 1 night.
1881.44	115.9	27.57	β. 3 nights.

AB and D.

	°	″	
1829.40	343.8	32.48	Σ. nights.
1851.84	339.2	33.74	OΣ. 2 nights.
1881.44	334.2	35.48	β. 3 nights.

κ. Delphini. OΣ. 533. (5.2 and 11.8.)

R. A. 20h 33m 17s.
Decl. +9° 40′.

	°	″			
1881.433	324.9	11.32	5.0..11.8	I	19:45
.447	323.4	11.38	5.0..12.0	I	19:25
.455	324.2	11.11	5.5..11.5	I	19:40

The change is due to the proper motion of the large star.

	°	″	
1868.10	345.7	9.41	De. 3 nights.
1878.18	329.2	10.59	β. 4 nights.
1881.44	324.2	11.27	β. 3 nights.

4. Aquarii. Σ. 2729.

R. A. 20h 45m 4s.
Decl. — 6° 4′.

	°	″			
1881.496	159.8	0.47	6.0..7.0	IV	19:50
.562	157.2	0.56	....	IV	20:10
.578	161.8	0.52	....	IV	18:40
1881.54	159.6	0.52			

S. 773. (8.3 and 8.5.)

R. A. 20h 59m 56s.
Decl. +35° 2′.

	°	″			
1881.608	29.8	84.10	8.5..8.8	I	18:30
.610	30.3	84.22	8.0..8.2	II	17:45
.709	30.3	84.05	8.3..8.5	I	21:30

No other measures since South.

	°	″	
1824.80	30.1	83.25	S. 2 nights.
1881.64	30.1	84.12	β. 3 nights.

Aquarii 45. β. 368. (6.9 and 7.7.)

R. A. 21h 1m 1s.
Decl. —8° 43′.

	°	″			
1881.578	86.8	0.52	6.6..7.2	IV	19:00
.616	90.8	0.71	7.0..7.8	III	19:40
.692	93.5	0.67	7.0..8.0	III	19:50

The following are all the measures:

	°	″		
1876.78	97.1	0.55	De.	5 nights.
1879.24	89.6	0 67	Cin.	5 nights.
1881.63	90.4	0.63	β.	3 nights.

δ. Equulei. OΣ. 535.

R. A. 21h 8m 38s.
Decl. +9° 31′.

A and B.

	°	″			
1881.395	22.1	0.39	5.0..5.2	IV	19:25
449	22.2	0.40	5.0..5.1	IV	20:00
.493	22.6	0.38	5.0..5.1	IV	19:00
.496	21.3	0.36	5.0..5.1	IV	20:15

AB and C. (Σ. 2777.)

	°	″			
1881.433	22.2	38.47	......	I	19:35
.449	22.5	38.42	..9.0	III	20:15
.493	22.2	38.88	..9.5	III	19:10

A rapid binary, supposed to have a period of about 14 years, or possibly half of that. The only measures made before those given below, are by OΣ., and they are not near enough together to determine the period, until further continuous measures are made. The change in the distant star is the result of the proper motion of AB.

A and B.

	°	″		
1880.60	29.1	0.35	β.	5 nights.
1881.46	22.1	0.38	β.	4 nights.

AB and C.

	°	″		
1833.20	38.8	27.40	Σ.	12 nights.
1836.65	37.4	28.07	Σ.	3 nights.
1863.14	27.0	33.76	De.	8 nights.
1880.60	22.7	37.98	β.	4 nights.
1881.46	22.3	38.59	β.	3 nights.

ε. Capricorni. *H.* 3040. (4.5 and 8.5.)

R. A. 21h 30m 22s.
Decl. −20° 0′.

	°	″			
1881.644	47.8	68.75	4.5..8.7	I	21:15
.668	47.4	68.69	8.3	I	19:30
.698	47.3	68.59	8.5	II	20:15
1881.67	47.5	68.68			

Σ. 2809. (6.6 and 8.5.)

R. A. 51h 31m 24s.
Decl. −0° 56′.

	°	″			
1881.644	163.0	31.27	6.8..8.5	I	21:10
.647	163.0	31.40	6.5..8.5	I	20:15
.668	163.2	31.32	6.5..8.5	I	19:40

No other recent measures, but unchanged.

	°	″	
1828.77	163.5	31.05	Σ. 5 nights.
1881.65	163.1	31.33	β. 3 nights.

Σ. 2817. (8.3 and 8.4.)

R. A. 21h 36m 19s.
Decl. —0° 6′.

	°	″			
1881.644	156.0	26.12	8.5..8.6	II	20:50
.647	155.8	26.13	8.3..8.3	I	20:05
.668	155.7	26.14	8.2..8.2	I	19:45

No other late measures. Evidently without sensible change.

	°	″	
1828.75	156.3	25.94	Σ. 3 nights.
1881.65	155.8	26.13	β. 3 nights.

Σ. 2837. (8.5 and 8.5.)

R. A. 21h 42m 49s.
Decl. +82° 23′.

	°	″			
1881.458	301.1	2.68	8.5..8.7	III	16:55
.460	301.9	2.66	8.5..8.5	II	16:40
.493	301.4	2.66	8.4..8.4	I	16:15

Change in angle and distance is clearly shown:

	°	″	
1832.30	321.3	2.16	Σ. 3 nights.
1866.24	306.3	2.31	De. 3 nights.
1881.48	301.5	2.67	β. 3 nights.

Sh. 336. (8.0 and 8.5.)

R. A. 21h 50m 36s.
Decl. +5° 27′.

	°	″			
1881.502	224.7	102.17	8.0..8.5	I	21:10
.581	225.2	102.24	8.0..8.5	I	21:40
.600	224.8	102.11	8.0..8.7	I	19:30

No other measures since South and Herschel.

	°	″	
1823.77	226.0	105.86	Sh. 1 night.
1881.56	224.9	102.17	β. 3 nights.

H. 951. (8.7 and 9.0.)

R. A. 21h 56m 14s.
Decl. +32° 8′.

	°	″			
1881.419	86.4	9.20	8.8..9.0	I	19:25
.499	85.8	9.63	8.7..9.0	I	20:10
.586	85.0	9 46	8.5..9.0	II	20:47

Herschel's first estimate of the distance was 10″, and later only 8½″, from which he inferred change. The only measures of distance are:

	°	″	
1873.50	87.3	8.90	De. 1 night.
1881.50	85.7	9.43	β. 3 nights.

Anon. (8.5 and 8.9.)

R. A. 21h 59m 49s.
Decl. −2° 39′.

	°	″			
1881.638	32.8	2.59	8.5..9.0	I	20:30
.641	33.4	2.68	8.5..8.8	I	21:00
.644	34.5	2.77	8.6..9.0	II	20:20

A pair of small stars found at the Harvard College Observatory. The only measures are:

	°	″	
1869.90	29.8	3.26	Hd. 1 night.
1881.64	33.6	2.68	β. 3 nights.

30 Pegasi. H. 962. (6.0, 12.0 and 12.3.)

R. A. 22h 14m 25s.
Decl. +5° 11′.

A and B.

	°	″			
1881.638	22.6	6.26	6.0..11.5	II	20:45
.641	19.1	6.32	6.0..12.0	II	22:20
.644	20.4	6.23	..12.0	II	20:05

A and C.

	°	″			
1881.638	222.5	9.93	..12.0	II	20:40
.641	223.5	10.18	..12.5	II	22:20
.644	222.4	10.12	..12.4	II	20:10

All the measures of this fine triple are of recent date:

A and B.

	°	″	
1867.	19.8	6.18	De. 3 nights.
1876.77	17.3	5.97	Hl. 4 nights.
1878.59	18.6	6.22	β. 1 nights.
1881.64	20.7	6.27	β. 3 nights.

A and C.

	°	″	
1876.77	221.1	9.94	Hl. 4 nights.
1879.74	223.0	9.79	Cin. 1 night.
1878.59	223.0	10.04	β. 1 night.
1881.64	222.8	10.08	β. 3 nights.

β. 174. (8.1 and 11.3.)

R. A. 22h 22m 58s.
Decl. —10° 17′.

	°	″			
1881.602	292.3	9.25	8.0..11.5	I	21:00
.616	292.6	9.02	8.0..11.0	I	19:50
.622	292.8	8.96	8.3..11.5	I	20:10

There is some evidence of change. The following are all the measures:

	°	″	
1876.15	287.9	7.38	De. 3 nights.
1878.77	290.6	9.09	Cin. 2 nights.
1881.61	292.6	9.08	β. 3 nights.

β. 706.

R. A. 22h 28m 21s.
Decl. +67° 41′.

A and B.

	°	″			
1881.540	....	2.79	7.8..13	I	16:50
.717	16.9	2.79	8.0..12	I	19:35
1881.63	16.9	2.79	7.9..12.5		

A and C.

	°	″			
1881.540	.....	29.36	.10.5	I	16:45
.717	234.3	29.23	..11.0	I	19:40
.747	237.4	28.91	..11.5		
1881.67	235.8	29.17	..11.0		

12 Lacertæ. S. 815. (5.7 and 9.7.)

R. A. 22h 36m 6s.
Decl. +39° 36′.

	°	″			
1881.414	15.9	70.92	6.0.. 9.5	I	18:50
.419	16.1	70.25	6.0..10.5	I	19:25
.449	15.8	70.34	5.0.. 9.0	I	18:35

No other measure since South.

1825.27	16.5	72.07	S. 2 nights.
1881.42	15.9	70.50	β. 3 nights.

β. 382. (6.9, 8.5 and 10.7.)

R. A. 22h 48m 18s.
Decl. +44° 7′.

A and B.

	°	″			
1881.671	207.4	1.12	....	III	19:20
.711	212.5	1.09	7.0..8.0	III	21:00
.717	210.5	1.05	6.8..9.0	III	20:40

A and C. (=H. 1828.)

	°	″			
1881.671	354.2	27.19	....	III	19:25
.711	353.5	27.08	..11.0	II	21:05
.717	353.7	26.75	..10.5	II	20:45

The following are all the measures:

A and B.

	°	″	
1876.39	205.7	1.07	De. 7 nights.
1881.70	210.1	1.09	β. 3 nights.

A and C.

	°	″	
1876.24	353.6	26.43	De. 3 nights.
1881.70	353.8	27.01	β. 3 nights.

R. 5898. (AB.=7.9; C.=10.9; D.=8.3; E.=8.5.)

R. A. 22h 52m 28s.
Decl. +72° 12′.

A and B (=OΣ. 484.)

	°	″			
1881.589	90.4	0.33	8.0..8.5	IV	19:25

AB and C (=Σ. 2966 rej.)

	°	″			
1881.531	256.4	31.00	..10.8	I	19:30
.559	256.8	30.82	..11.0	I	19:55

AB and D (=S. 820.)

	°	″			
1881.529	280.1	120.91	8.0..8.5	I	18:30
.531	279 9	121.00	7.8..8.2	I	19:15
.559	280.2	121.48	7.8..8.4	I	20:00
.589	279.8	121.38	8.0..8.3	III	19:15

D and E (=Σ. 2965.)

	°	″			
1881.529	220.1	2.98	8.5..8.8	I	18:35
.531	217.9	3.25	8.2..8.4	I	19:25
.559	218.6	3.24	8.4..8.6	I	19:50
.589	218.5	2.79	8.0..7.3	III	19:00

The close pair was discovered by $O\Sigma$. The difficulty of measuring so close a pair may explain the differences in the angles. The following are all the measures:

A and B.

	°	″	
1846.42	117.7	0.36	$O\Sigma$. 2 nights.
1855.56	99.3	0.46	$O\Sigma$. 2 nights.
1867.66	89.5	....	De. 2 nights.
1880.03	92.6	0.33	β. 2 nights.
1881.59	90.4	0.33	β. 1 night.

Struve only saw the distant star C, and subsequently rejected it as a double star in Meusuræ Micrometricæ. The only measures of this star are:

AB and C.

	°	″	
1855.56	255.4	30.72	$O\Sigma$. 2 nights.
1881.54	256.6	30.91	β. 2 nights.

The wide pair, AD. is certainly S. 820, though the R. A. given by South is about 8m less. There is nothing in or near that place. As this star has not been before identified, there are no other measures.

AB and D.

	°	″	
1825.27	279.3	120.89	S. 3 nights.
1881.55	280.0	121.19	β. 4 nights.

As will be seen from the following measures there is no sensible change in the Struve pair:

	°	″	
1832.56	217.9	3.09	Σ. 3 nights.
1858.44	216.4	2.17	$O\Sigma$. 1 night.
1881.55	218.8	3.07	β. 4 nights.

H. 1838. (8.4 and 8.6.)

R. A. 22h 53m 59s.
Decl. +66° 27′.

	°	″			
1881.502	268.9	1.92	8.3..8 5	I	20:15
.529	269.9	1.67	8.5..8.6	I	18:45
.531	270.5	1.81	8.5..8.7	II	19:40

Change isnot to be inferred from estimates. The following are all the observations:

	°	″		
1828.±	90.±	1.±	H. 1 night.	11=11
1879.75	265.9	2.10	Cin. 2 nights.	
1881.52	269.8	1.80	β. 3 nights.	

H. 3158. (8.5 and 8.5.)

R. A. 22h 54m 56s.
Decl. +70° 7′.

	°	″			
1881.531	214.0	1.06	8.5..8.7	II	19:50
.559	216.8	0.95	8.5..8.5	I	18:00
.630	216.7	1.06	8.5..8.5	III	21:30
1881.57	215.8	1.20			

H gives angle 45° ±, and distance ½", and says, "almost certain this star is double. Position and distance from diagram." There are no other measures than those given above.

π Cephei. OΣ. 489. (4.5 and 8.7.)

R. A. 23h 4m 5s.
Decl. +74° 41′.

	°	"			
1881.652	27.3	1.39	4.5..9.0	III	21:05
.668	27.4	1.18	.....8.0	IV	22:05
.717	27.1	1.36	.....9.0	III	19:30

Some of the measures of this binary are:

	°	"	
1846.48	351.4	1.15	OΣ. 2 nights.
1867.12	14.8	1.27	De. 5 nights.
1881.68	27.3	1.31	β. 3 nights.

2. Cassiopeæ. S. 823. (6.2 and 8.3.)

R. A. 23h 4m 37s.
Decl. +58° 41′.

	°	"			
1881.647	163.0	167.91	6.0..8.3	I	20:50
.652	163.4	167.73	6.3..8.0	II	19:30
.657	163.2	......	....	I	18:25
.660	163.1	167.90	6.3..8.6	II	20:05

The following are all the measures:

	°	"	
1824.70	163.3	166.68	S. . nights.
1881.65	163.2	167.85	β. 3 nights.

β. 80. (8.0 and 8.8.)

R. A. 23h 12m 42s.
Decl. +4° 45′.

	°	"			
1881.641	311.9	0.81	8.0..8.7	III	22:40
.709	312.0	0.98	8.0..9.0	III	22:00
.717	312.7	0.93	8.3..8.7	III	21:00

Argelander gives the proper motion of this star as 0".558 in the direction of 101.°5. It is evident from the following measures that the components have the same movement in space, and form a binary system:

	°	"	
1875.80	300.4	1.07	De. 4 nights.
1881.59	312.2	0.91	β. 3 nights.

P. XXIII. 100. OΣ. 496.

R. A. 23h 24m 29s.
Decl. +57° 53′.

A and B.

	°	"			
1881.575	346.2	1.38	6.8..11.0	IV	21:10
.630	346.3	1.35	6.5..11.0	III	20:55

C and D.

	°	″			
1881.589	224.7	1.39	....	IV	19:40
.619	219.4	1.25	8.0.. 9.5	III	17:55
.622	219.1	1.44	8.5..10.5	III	18:00

A and C.

	°	″			
1881.589	268.7	75.72	....	II	20:40
.619	269.2	75.96	....	II	18:00
.622	269.2	76.00	....	III	18:05

An interesting quadruple group with several faint distant companions. The close star, B, was suspected by $O\Sigma$. in 1845, but measured only once subsequently, in 1851. It does not appear to have been seen from that time till 1880. There is no evidence of any great change. The duplicity of the distant companion, measured by South and Herschel, was discovered by Dawes in 1841, and independently by $O\Sigma$. later. These stars appear to have remained unchanged. The following are the measures of AB:

A and B.

	°	″		
1851.76	336.8	1.51	$O\Sigma$.	1 night.
1880.72	343.3	1.38	β.	2 nights.
1881.60	346.2	1.37	β.	2 nights.

C and D.

	°	″		
1849.64	224.2	1.38	$O\Sigma$.	5 nights.
1867.94	223.8	1.39	De.	4 nights.
1880.72	225.5	1.39	β.	2 nights.
1881.61	221.1	1.36	β.	3 nights.

A and C.

	°	″		
1849.64	269.2	76 10	$O\Sigma$.	5 nights.
1860.68	269.3	75.63	De.	3 nights.
1880.65	268.9	75.60	β.	3 nights.
1888.61	269.0	75.90	β.	3 nights.

The principal measures of the several faint companions are:

A and a.

	°	″			
1869.76	114.0	43.36	De.	2 nights.	$a=$ 9.7
1880.65	114.7	43.53	β.	3 nights.	10.5

A and b.

	°	″			
1869.76	338.5	67.11	De.	2 nights.	$b=$ 9.2
1880.65	338.5	66.91	β.	3 nights.	10.5

C and d.

	°	″			
1880.65	337.1	26.87	β.	2 nights.	$d=$11.6

b and c.

	°	″			
1869.76	73.5	10.29	De.	2 nights.	$c=$ 9.6
1880.64	74.4	10.85	β.	2 nights.	10.5

Σ. 3038. (9.3 and 9.4.)

R. A. 23h 40m 24s.
Decl. +62° 0′.

	°	″			
1881.493	278.0	4.66	9.0..9.0	I	21:15
.599	276.2	4.96	9.7..9.8	I	17:00
.504	275.4	4.56	9.2..9.3	I	20:25

Probably without sensible change.

	°	″	
1833.83	275.0	4.36	Σ. 3 nights.
1867.01	274.8	4.33	De.
1881.50	276.5	4.73	β. 3 nights.

Sh. 358. (8.0 and 9.7.)

R. A. 23h 48m 13s.
Decl. +31° 14′.

	°	″			
1881.499	327.9	37.68	8.0.. 9.5	I	19:45
.504	327.0	37.35	8.0.. 9.5	I	20:50
.586	328.4	37.76	8.0..10.0	II	20:35

If the single measure of Sh. is correct, the distance has diminished. The following are all the measures.

	°	″	
1822.29	329.2	41.29	Sh. 1 night.
1881.53	327.8	37.60	β. 3 nights.

OΣ. (App.) 253. (8.0 and 8.2.)

R. A. 23h 54m 59s.
Decl. +68° 54′.

	°	″			
1881.647	353.2	100.93	8.0..8.2	I	21:20
.654	353.7	100.54	8.0..8.3	II	21:00
.663	353.5	100.48	....	II	18:00

The only measures are the following:

	°	″	
1874.78	353.3	100.51	De. 2 nights.
1881.65	353.5	100.65	β. 3 nights.

OΣ. (App.) 254. (8.0 and 8.4.)

R. A. 23h 55m 8s.
Decl. +59° 21′.

	°	″			
1881.647	89.6	58.83	....	I	21:05
.652	89.5	58.72	8.0..8.5	II	19:00
.660	89.5	58.96	8.0..8.4	II	20:15

The larger star is red, No. 280, of Schjellerup's Catalogue. The following are all the measures:

	°	″	
1873.64	89.7	58.84	De. 2 nights.
1881.65	89.5	58.84	β. 3 nights.

85 Pegasi.

R. A. 23h 55m 52s.
Decl. +27° 27′.

A and B.

	°	″			
1881.575	311.5	0.58	..11.0	IV	22:15

A and C.

	°	″			
1881.449	20.1	16.12	6 0..9.0	III	18:40
.562	21.1	16.14	....	III	21:00
.675	21.1	16.44	....	IV	22:00
.586	20.8	16.47	....	II	20:25

A most interesting system from the large proper motion, and parallax of the principal star. The close star was discovered in 1878. The measures show rapid orbital motion. The motion in space is evidently common to both components. Brunnow, from measures of A and C, finds a parallax of 0.″054 for the principal star. With this instrument the close pair is now excessively difficult, and the measure is not so certain as those previously made. The distance appears to be diminishing, and if so, it will soon be beyond the reach of even the largest refractors. The following are all the measures of the new star:

A and B.

	°	″	
1878.73	274.0	0.67	β. 3 nights.
1879.46	284.6	0.75	β. 5 nights.
1880.59	298.3	0.65	β. 5 nights.
1881.57	311.5	0.58	β. 1 night.

A and C.

	°	″	
1878.54	33.6	14.40	β. 4 nights.
1878.95	31.9	14.76	β. 4 nights.
1879.61	29.1	15.21	β. 3 nights.
1880.57	25.0	15.41	β. 6 nights.
1881.54	20.8	16.29	β. 4 nights.

β. 281.

R. A. 23h 56m 38s.
Decl. +1° 28′.

A and B.

	°	″			
1881.709	212.8	1.32	7.5..9.5	III	21:45
.747	212.4	1.18	7.5..9.0	III	22:10
1881.73	212.6	1.25	7.5..9.2		

A and C. (= H. 998.)

	°	″			
1881.709	336.7	31.03	..11.0	III	21:50
.747	336.8	30.66	..11.5	III	22:15
1881.73	336.7	30.85	..11.2		

Σ. 3057. 7.5 and 9.7.)

R. A. 23h 58m 43s.
Decl. +57° 52′.

	°	″			
1881.589	301.7	3.54	7.6.. 9.5	II	22:00
.608	300.6	4.00	7.5..10.0	II	19:00
.610	301.3	3.77	7.5.. 9.5	II	18:45

The principal star has an annual proper motion, according to Argelander, of 0″.279 in the direction of 84°.9. The small star is evidently moving through space with the other.

	°	″	
1832.29	299.5	3.64	Σ. 3 nights.
1881.60	301.2	3.71	β. 3 nights.

Σ. 3059. (9.3 and 9.6.)

R. A. 23h 58m 55s.
Decl. +82° 2′.

	°	″			
1881.652	331.3	2.10	9.5..9.8	II	20:50
.666	329.7	2.14	9.3..9.6	I	20:20
.692	333.2	2.03	9.0..9.4	I	20:30

Probably unchanged. The following are all the measures:

	°	″	
1833.43	334.8	2.35	Σ. 3 nights.
1879.75	327.6	....	Cin. 1 night.
1881.67	331.4	2.09	β. 3 nights.

Σ. 3062. (7.2 and 7.8)

R. A. 23h 59m 57s.
Decl. +57° 46′.

	°	″			
1881.589	307.1	1.56	7.5..8.0	II	21:50
.608	307.1	1.58	7.0..7.4	III	18:50
.610	307.8	1.65	7.0..8.0	III	18:30

A well-known binary. Doberck (1877) finds period of 104.4 years. Some of the late measures are:

	°	″	
1877.50	295.7	1.47	De. 5 nights.
1879.45	301.9	1.50	Hl. 8 nights.
1880.60	304.5	1.50	β. 6 nights.
1881.60	307.8	1.60	β. 3 nights.

VIII. OBSERVATIONS OF 84 RED STARS AND REDUCE A LIST OF 27 NEW RED STARS DISCOVERED IN THE ZONE OBSERVATIONS.

The following list of 84 red stars, 27 of which are new, includes those stars found in the zones up to this time, and those specially looked up, for purposes of comparison, by Mr. S. W. BURNHAM and myself. Although the list is short, it contains a few very fine stars, the most interesting being:

	h	m	s		°	′
Nova	1	58	45	+	58	40
β	13	42	15	—	27	46
Birmingham.	20	36	33	+	47	37

NAME.	R. A. 1880.			Decl. 1880.		Date: 1881.	Remarks.
	h	m	s	°	′		
Nova	1	48	45	+58	40	July 17	Fine red star; 9 mag.
Nova	2	42	5	+57	21	July 28	Good red star; 9 mag.
B. 50..............	2	43	43	+57	50	July 28	Not very red; 7–8 mag.
B. 242..............	10	31	38	−12	46	May 15	Good red star.
B. 243..............	10	34	54	+ 0	3	May 14	Not red; 9 mag.
B. 248..............	10	45	47	−20	37	May 15	Fine full red. A star 9–10 mag. in p=90°, s=30″.
B. 253..............	10	59	33	+ 0	3	May 14	No red star seen in this place.
h. 506..............	11	32	26	+39	51	May 14	Yellowish-red star.
B. 266..............	11	39	42	+48	27	May 14	χ *Ursæ* yellowish-red only.
B. 269..............	11	51	59	+ 4	10	May 14	Yellowish-red only.
B. 277..............	12	19	7	+ 1	27	May 1	Very full red.
B. 277..............	......	......	......	......	......	May 14	Fine red.
B. 281..............	12	24	14	+ 5	5	May 14	Reddish; 8.0 mag.
B. 286..............	12	34	56	+ 0	2	May 14	No red star in this place.
B. 288..............	12	38	16	− 0	50	May 14	No red star in this place.
B. 292..............	12	44	34	− 0	6	May 14	No red star in this place.
B. 299..............	12	52	10	+18	25	May 14	Reddish; not red and not "double."
B. 309..............	13	25	43	− 5	38	May 15	Strong yellow; very little red.
Burnham's Nova ...	13	42	15	−27	46	May 15	Splendid red star.
B. 317	13	58	41	+ 0	7	May 14	Yellowish; not full red.
B. 321..............	14	4	18	−15	44	May 15	Strong yellow; very little red.

Name.	R. A. 1880.			Decl. 1880.		Date: 1880.	Remarks.
	h	m	s	°	′		
B. 321	14	4	18	−15	44	May 29	Strong red yellow; 5–6 mag.
h. 1249	14	10	25	−15	58	May 24	Reddish 8.8 mag. A star 11 mag. in p = 180°, s = 8″.
B. 327	14	18	24	+ 8	38	May 11	Yellowish red; not red.
B. 327	...			...		May 14	Fine yellow; not red.
B. 328	14	18	47	+26	15	May 11	Full red; 8 mag.
B. 328	...			...		May 14	Fine red.
B. 329	14	23	24	− 5	27	May 11	A little reddish.
B. 329	...			...		May 15	Not red; a little reddish.
Nova	14	33	58	−14	47	May 29	Red; 8 mag.
Nova	14	51	9	−11	57	May 29	Strong reddish yellow; 7.8 mag.
B. 343	14	57	3	−24	48	May 15	Not red.
B. 344	14	59	56	−15	47	May 15	Not red; strong yellow.
Nova=B. A. C. 4984	15	2	52	−28	31	May 22	Red; 7.5 mag.
Nova	15	15	34	−28	45	May 22	Red; 8.5 mag.
B. 355	15	29	45	−27	44	May 15	Not a red star.
Nova	15	31	..	−12	40	May 29	Reddish; 8.3 mag.
Nova=43 Libræ	15	35	20	−19	17	May 18	Strong reddish yellow.
Nova	15	41	34	−19	47	May 29	Reddish; 8 mag.
Nova=B. A. C. 5347	16	1	49	−26	0	June 2	Strong red-yellow; 6.5 mag.
B. 369	16	2	11	+22	9	May 14	Not red; straw color.
Nova	16	2	27	−26	8	June 2	Reddish-yellow; 7.5 mag.
B. 372	16	3	35	+ 1	8	May 14	Not red; lemon-yellow.
Nova	16	14	20	−34	0	June 2	Red; 9 mag.
Nova	16	32	30	−12	5	May 28	Red; 8 mag.
Nova	16	44	51	− 0	15	May 22	Dull red; 8 mag.
Nova	17	9	25	−15	6	May 29	Red-yellow star; 7.5 mag.
B. 407	17	13	44	+ 2	17	May 14	Red; 7 mag.
Nova	17	23	32	−33	58	June 13	Good red star; 9 mag.
Nova	17	28	13	−33	25	June 13	Red; 8.5 mag.
B. 413	17	28	28	+12	36	May 14	No red star in this place.
B. 416	17	35	25	+31	16	June 5	Reddish-yellow; 6.5 mag.
Nova	17	41	26	− 3	36	May 20	Red; 8 mag.
Nova	...			...		May 23	Red; 8 mag.
Nova	17	46	0	−34	47	May 20	The s. p. star of M. 7. It is of quite a different color from the others. Reddish-yellow.
B. 422	17	52	2	+ 2	44	May 14	Yellowish red.
B. 424	17	54	44	−27	47	May 20	Dull red; not "beautiful ruby."
Nova	18	7	24	−29	52	June 19	Reddish; 8 mag.
B. 431	18	7	50	+22	48	May 14	Pale yellow; not red.

NAME.	R. A. 1880.			Decl. 1880.		Date: 1881.	Remarks.
	h	m	s	°	″		
Nova	18	8	1	−18	57	June 13	Dull red; 8 mag.
Nova	18	11	20	−18	18	May 20	Dull red; 8 mag.
B. 435	18	13	19	+ 0	48	May 14	Faintly reddish.
B. 436	18	16	0	+ 0	6	May 14	Faintly reddish.
B. 437	18	16	33	+25	0	May 14	No red star 7.5 mag. here.
B. 448	18	28	9	+36	54	May 14	Fine red; not "crimson."
B. 456	18	36	9	+ 0	2	May 14	Yellowish.
B. 458	18	38	40	+36	51	May 14	No really *red* star here.
B. 465	18	46	46	+ 9	5	May 14	A red star, 8 mag., near this place.
B. 473	18	51	26	+ 0	18	May 14	Red.
B. 475	18	52	4	+14	12	May 14	Good red star; it has a companion 30″ off of a different color.
B. 487	19	3	37	+23	59	May 14	Yellowish-red; companion not specially blue.
Nova=$O\Sigma$.(app.) 181	19	15	15	+26	26	May 14	One component red.
Nova=4 Vulpeculæ.	19	20	12	+19	34	May 14	Reddish.
B. 494=3 Cygni	19	20	29	+24	42	May 14	Fine yellow red star.
B. 495	19	21	4	+19	34	May 14	Red.
B. 497	19	21	38	+35	55	May 14	Yellowish-red.
B. 505	19	27	26	−16	38	Aug. 21	Fine red; 7.7 mag.
B. 509	19	36	22	+32	20	May 14	Red.
B. 511	19	39	1	+12	57	May 14	Reddish.
Nova=h. 1470	19	59	19	+37	59	May 24	Reddish star; blue companion.
B. 553	20	15	54	+47	31	June 17	Red; 8 mag.
Birmingham	20	36	33	+47	37	June 17	Blood red; 8.7 mag.
Nova	21	0	33	−16	54	Sept. 9	Red; 8.5. O. A. S. 21124–5.
B. 592	21	38	18	+37	28	Aug. 9	Fine red.
B. 596	21	40	19	− 2	46	Aug. 9	Red-yellow.
B. 600	21	58	32	+27	46	Aug. 9	Red-yellow.
B. 609	22	11	26	+ 4	33	Aug. 9	Faintly reddish.
Nova=h. 980	23	5	8	+ 4	21	May 25	Reddish; 8 mag.
B. 656	23	52	19	+50	43	July 17	Vivid red; 7 mag.
B. 658	23	55	8	+59	41	Aug. 26	Good red star; 7.8 mag.; blue companion 8.2, S=58.″8. This is $O\Sigma$. 254.

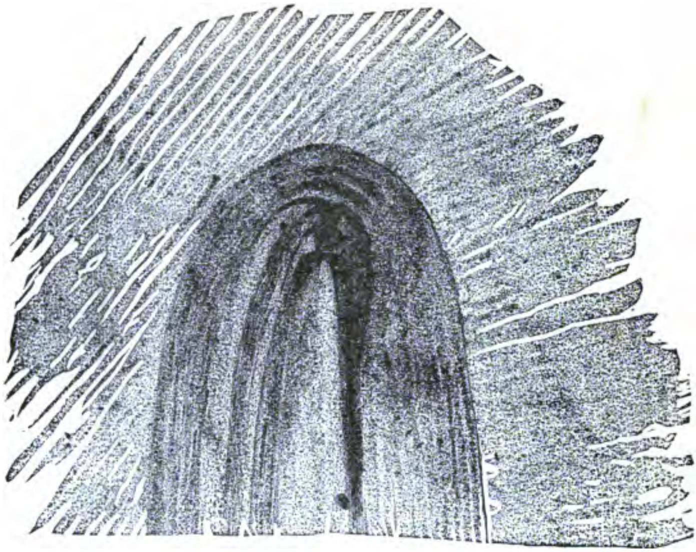

Fig. 1. June 24.

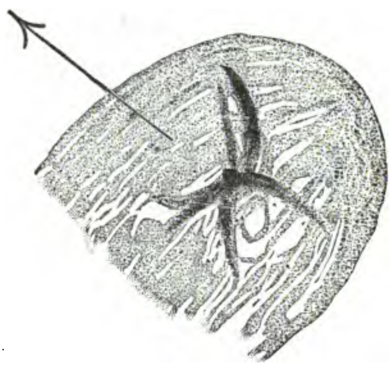

Fig. 2. June 25.

Fig. 3. June 26.

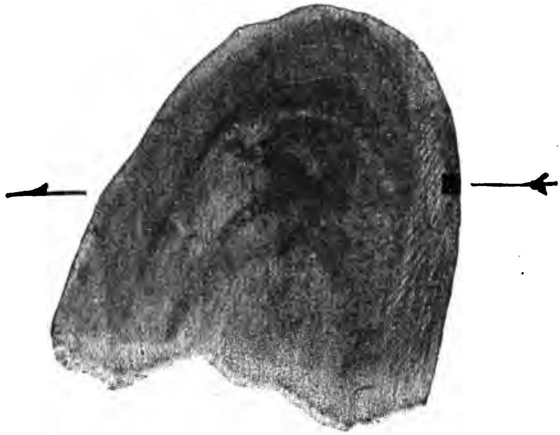

Fig. 4. June 27.

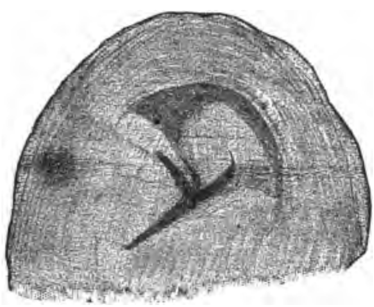

Fig. 5. June 28.

Fig. 6. June 29.

Fig. 7. July 8.

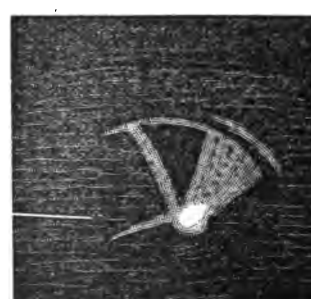

Fig. 8. July 11.

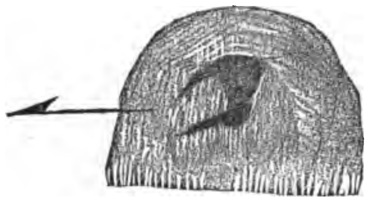

Fig. 9. July 13.

Fig. 10. July 14.

Fig. 11. July 17.

Fig. 12. July 18.

IX. OBSERVATIONS AND DRAWINGS OF THE GREAT COMET OF 1881.

The following observations were made by myself with the $15\frac{1}{2}$ inch equatorial and the zone eyepiece. The cuts are facsimiles of drawings made at the telescope and are kindly lent by the editor of *Science*. Except in the cut of July 11, the darker the shading the brighter the corresponding part of the comet.

The Washburn Observatory is $0^h\ 49^m\ 25^s{\cdot}8$ west of Washington. The *times* are, however, Chicago mean times, or correspond to a meridian $0^h\ 7^m\ 11^s{\cdot}1$ east of our own, that is, $0^h\ 42^m\ 14^s{\cdot}7$ west of Washington.

Figure 1; June 24, 14^h m. t.— This figure is intended to show the whole structure of the head of the comet, with its envelopes. There is a star within the tail.

Figure 2; June 25, 10^h m. t.— Sky hazy and outlines of the comet not well seen. The drawing shows only the structure of the head. The nucleus is not round and is eccentric in the envelopes. The arrow shows the parallel.

Figure 3; June 26, $11^h\ 22^m$ m. t.— Hazy and cloudy.

Figure 4; June 27, 13^h m. t.

Figure 5; June 28, 10^h m. t.

Figure 6; June 29, $9^h\ 30^m$ m. t.— I was absent from Madison till July 8.

Figure 7; July 8, $10^h\ 35^m$ m. t. Moonlight. The nucleus is not double. There is a dark narrow channel between the following side of the nucleus and the envelopes, as in the figure.

Figure 8; July 11, $9^h\ 30^m$ m. t.— Strong moonlight and twilight. This cut gives bright portions of the comet by white lines.

Figure 9; July 13, $9^h\ 30^m$ m. t.

Figure 10; July 14, $10^h\ 20^m$ m. t.— Moonlight.

Figure 11; July 17, $10^h\ 45^m$ m. t.

Figure 12; July 18, $9^h\ 30^m$–$11^h\ 0^m$ m. t.— The nucleus is double (it has not been previously), $p=275°$, $s=1''{\cdot}5$, with a dark space between the parts.

July 19; 9^h 45^m m. t.—Appearances same as last night, but fainter. The nucleus is elongated in $p=280°\pm$. The second nucleus is in $p=270°$, $s=1''$ to $2''$.

July 24; 9^h 35^m m. t.—The nucleus is double, $p=225°$ (4), $s=2''\cdot62$ (3). The diameter of the principal nucleus in $p=135°$, is $1''\cdot68$ (2).

The micrometer measures by Mr. BURNHAM.

July 26; 9^h 3^m m. t. The nucleus is round.

July 27; 10^h 10^m m. t.—The nucleus seems elongated in $p=250°$, but I am not sure.

After this date the comet was examined on several occasions without finding any peculiarity worthy of mention. It is to be noted that there is no doubt whatever as to the fact that the nucleus was double on July 18, July 19 and July 24. I am almost equally positive that it was not double on the other dates specified.

It appears to me that these observations are of interest in connection with those of Prof. O. STONE at the Cincinnati Observatory, and of Mr. WENDELL at the Harvard College Observatory.

X. MISCELLANEOUS OBSERVATIONS.

[NOTE.—The times given are Chicago mean times.]

Meteor.— On April 4, 1881, at 7^h 25^m, a bright meteor was seen to move from a few degrees north of the equator on the meridian, towards the s. s. w., passing near *θ. Orionis.* About 10° or 15° below *θ.* it exploded, and its train was visible 10° or 15° further. It was of the same color as and about of the brightness of Venus, with which it was immediately compared.

Aurora Borealis.— Displays of the Aurora have been seen as follows: 1881, April 18, from 10^h 0^m to 10^h 5^m. It may have been visible a few minutes before 10^h, but certainly not long before. It vanished quite suddenly at 10^h 5^m. 1881, April 27, an arch with streamers appeared at 9^h 55^m; the streamers disappeared about 10^h 0^m, but the arch remained till 13^h 25^m, when it was hidden by clouds. 1881, April 28: Aurora beginning at 12^h 20^m. 1881, August 20: Bright aurora first seen at 12^h 30^m. 1881, November 23: Bright aurora from 8^h 10^m till after midnight.

Transit of Mercury.— The first and second contacts of the transit of Mercury, Nov. 7, 1881, were observed by Mr. BURNHAM and myself at the Lick Observatory, Mount Hamilton, California, as follows:

HOLDEN.

Contact I; 2^h 11^m $02^s.3$.
Contact II; 2^h 12^m $25^s.8$.

BURNHAM.

Contact I; 2^h 10^m $41^s.1$.
Contact II; 2^h 12^m $5^s.7$.

Duration of ingress, HOLDEN; 1^m $23^s.5$.
Duration of ingress, BURNHAM; 1^m $24^s.6$.

The times are local mean times.

My observations were made with a 4-inch comet seeker, a polarizing eye-piece and the highest power I could fit to the apparatus,— about fifty diameters. Mr. BURNHAM'S were made with

the 12-inch equatórial, with aperture reduced to 6 inches, a polarizing eye-piece, and a power of about 300–400 diameters.

The position of the observatory is assumed to be:

$\lambda = 2^h\ 58^m\ 14^s.6$ W. from Washington.

$\Phi = +37°\ 21'\ 3''$.

It is quite possible that this position is as much as one mile out of the way.

METEOROLOGICAL CONSTANTS FOR MADISON.

I have asked Mr. C. A. Shaw, Observer of the United States Signal Service, to extract for me from the records of his office such meteorological data as would serve to exhibit the character of the climate of Madison for the last ten years. This he has very kindly done in the most complete manner, and his tables are printed in what follows.

From these valuable tables the following deductions may be drawn, using the means of the whole ten years of observation:

The *clear days* (cloudiness from 0 to $\frac{8}{30}$) are 27.8 per cent. of all.
The *fair days* (cloudiness from $\frac{9}{30}$ to $\frac{21}{30}$) are 42.8 per cent. of all.
The *cloudy days* (cloudiness from $\frac{22}{30}$ to 1) are 29.4 per cent. of all.

Or in other words, the 365 days of any year are likely to be divided into 102 *clear days*, 156 *fair days* and 107 *cloudy days.*

The mean actual reading of the *Barometer* (reduced to 32°) was 28.949 inches.

The mean *Thermometer* was 46.°0 F. (according to the Smithsonian Temperature tables the mean annual temperature is 45.°4 F.)

The mean *Relative Humidity* was 72.5. The mean *cloudiness* was 4.9 (10=perfectly cloudy).

The *highest temperature for any month* (July, 1874) was 96° F.

The *lowest temperature for any month* (December, 1872) was −28° F.

The mean *rain fall* (from the observations of 1879, 1880 and 1881) was 44.96 inches.

A SUMMARY OF THE METEOROLOGICAL RECORDS AT MADISON FOR THE YEARS 1872–1881, INCLUSIVE.

Compiled by C. A. Shaw, *Observer, U. S. Signal Service.*

In the following tables, the amount of cloudiness is estimated on a scale of 0 to 10, a clear day being one on which the sum of the amount of the clouds of the three daily observations does not exceed 8, a fair day, one from 9 to 21, inclusive, and a cloudy day, from 22 to 30.

There was no instrument available to measure the velocity and

force of the wind until October, 1878. As it was estimated on a scale of 0 to 5, or light, gentle, fresh, brisk, gale, the actual velocity cannot be accurately determined, and it is given as estimated from the records.

The excess of the number of days on which rain fell, during the last three years, from Signal Service reports, is doubtless due to more accurate attention to minute precipitation. From 1872 to 1878, inclusive, the data are extracted from records kept at the University of Wisconsin. After that date they are copied from the books of the U. S. Signal Service station in the city of Madison. Those numbers enclosed in ( ) are not means, but maxima or minima.

OBSERVATIONS AT MADISON, WISCONSIN, IN 1872.

1872.	No. of clear days.	No. of fair days.	No. of cloudy days.	Actual Barom. red. to 32.°	Mean Thermom.	Mean relative humidity.	Mean cloudiness.	Direc'n of wind.	Force of wind.	Rain or snow.	Highest Temp.	Lowest Temp.	Range.	No. of days when rain or snow fell.	Max. Veloc. of wind.	Barom. Constant.[1]
									Miles.	Inches.	°	°	°			
January	10	11	10	28.916	17.5	90	4.8	SW	5.0	1.20	40	−15	55	4	30	1.080
February	9	14	6	28.899	19.2	88	4.1	W	4.0	0.40	48	−10	58	2	40	1.080
March	8	15	8	28.758	23.8	82	4.8	N	5.2	2.18	40	3	37	9	30	1.060
April	11	12	7	28.870	45.8	56	4.5	SW	7.5	1.82	77	23	54	8	40	1.040
May	6	16	9	28.855	57.5	61	5.3	NW	6.1	2.83	79	39	40	7	30	1.020
June	12	12	6	28.858	67.0	64	4.4	S	5.5	2.44	90	55	35	7	30	1.010
July	11	17	3	28.892	73.4	65	4.2	SW	6.3	1.26	92	60	32	4	30	1.000
August	10	15	6	28.949	70.4	67	4.2	SW	6.0	2.24	90	53	37	6	40	1.010
September	11	13	6	28.854	62.1	71	4.3	SW	8.0	5.11	89	39	50	7	40	1.020
October	21	6	4	28.971	49.0	61	2.6	NW	6.0	0.60	76	30	46	3	40	1.040
November	10	12	8	28.900	27.2	85	4.7	NW	7.5	0.76	54	−4	58	3	40	1.070
December	8	13	10	29.043	9.5	96	5.3	NW	8.0	1.60	38	−28	66	7	50	1.080
Sum	127	156	83	......	......	......	......	......	......	22.44	......	......	......	67	Max.	
Mean	10.6	13.0	6.9	28.897	43.5	73.8	4.5	SW	6.3	1.87	(92)	(−28)	(120)	......	(50)	1.043
Percentage	35	42	23	......	......	......	......	......	......	......	......	......	......	......	......	......

[1] To reduce to sea level.

OBSERVATIONS AT MADISON, WISCONSIN, IN 1873.

1873.	No. of clear days.	No. of fair days.	No. of cloudy days.	Actual Barom. red. to 32°.	Mean Thermom.	Mean relative humidity.	Mean Cloudiness.	Direc'n of wind.	Force of wind.	Rain or snow.	Highest Temp.	Lowest Temp.	Range.	No. of days when rain or snow fell.	Max. Veloc. of wind.	Barom. Constant.
									Miles.	Inches.	°	°	°		1	
January	5	12	14	28.850	10.9	98	6.8	N....	9.0	1.40	38	—21	59	8	50	1 080
February	12	10	6	28.857	15.6	95	3.6	W ...	5.5	0.60	40	—20	60	1	30	1.080
March	10	14	7	28.886	30.8	75	4.5	NW..	8.8	2.07	52	— 5	57	6	40	1.060
April	4	14	12	28.801	42.4	66	6.5	NW..	5.2	1.26	80	29	51	4	40	1.040
May	10	12	9	28.842	55.2	66	5.1	E	6.5	3.53	76	39	37	8	40	1.020
June	15	13	2	28.862	73.0	68	2.8	SW..	5.5	5.60	89	55	34	8	40	1.010
July	14	15	2	28.928	71.7	68	4.5	W ...	6.0	0.82	91	53	38	5	30	1.000
August	10	12	3	28.957	71.9	69	3.2	SW..	5.0	2.76	91	58	33	5	50	1.010
September	14	11	5	28.930	55.4	67	3.6	NW..	8.5	2.54	87	40	47	7	40	1.020
October	14	7	10	28.914	45.1	68	4.7	SW..	8.5	1.96	73	20	53	6	40	1.040
November	5	14	11	28.886	28.2	85	5.9	NW..	8.0	2.15	50	2	48	7	40	1.070
December	5	11	15	28.998	26.0	88	5.9	SE...	7.0	1.80	43	2	41	6	40	1.080
Sum	124	145	96	....	......	......	......	......	......	26.49	....	....	....	71	Max.	......
Means	10.3	12.1	8.0	28.893	43.8	76.1	4.8	NW..	6.9	2.21	(91)	(-21)	(112)	....	(50)	1.043
Percentage	34	40	26	....	......	......	......	......	......	......	....	....	....	....	....	......

[1] Estimated.

OBSERVATIONS AT MADISON, WISCONSIN, IN 1874.

1874.	No. of clear days.	No. of fair days.	No. of cloudy days.	Actual Barom. red. to 32.°	Mean Thermom.	Mean relative humidity.	Mean cloudiness.	Direc'n of wind.	Force of wind.	Rain or snow.	Highest Temp.	Lowest Temp.	Range.	No. of days when rain or snow fell.	Max. Veloc. of wind.[1]	Barom. Constant.
									Miles.	Inches.	°	°	°			
January	6	10	9	28.978	18.9	90	5.8	SW ..	7.0	3.64	57	—12	69	9	40	1.080
February..........	11	9	8	28.995	21.0	91	4.5	SW ..	5.5	0.95	41	—10	51	3	30	1.080
March	11	12	8	28 985	29.7	69	4.4	W ...	6.0	0 95	56	10	46	3	40	1.060
April	10	15	5	29.031	36.8	66	4.0	NE..	6.5	1.26	63	13	50	5	40	1.040
May	15	8	8	28 893	59.4	67	4.1	NE..	6.0	2.14	90	42	48	7	40	1.020
June	10	13	7	28.878	63.3	78	4.2	SW ..	6.0	2.35	92	54	38	8	50	1.010
July	20	8	3	28.967	75.4	63	2.5	SW ..	9 0	5.19	96	62	34	5	40	1.000
August...........	9	16	6	28.970	71.1	65	4.2	NE..	8.5	1.40	93	58	35	6	30	1.010
September.........	15	8	7	28 961	64.4	73	4.0	SW ..	9.5	5 46	90	46	44	11	40	1:020
October	12	10	9	28.848	51.0	76	4.8	SE ..	6 0	1.44	71	30	41	4	30	1.040
November.........	10	14	6	28.970	32.6	77	4.4	W ...	8.0	3.29	69	— 3	72	8	40	1 070
December	3	19	9	28.977	22.6	84	5.9	NW..	8.3	0.45	50	—15	65	5	30	1.030
Sum....	132	148	85	.....	......	......	......	....	......	29.02	...	....	.....	74	Max.	....
Means............	11.0	12.3	7.1	28.952	45.8	74.9	4.4	SW ..	7.2	2.42	(96)	(—15)	(111)	.....	(50)	1.043
Percentage	36	41	23	....	......	......	......	....	......	....	.....	....	.....	.....	.....	....

[1] Estimated.

OBSERVATIONS AT MADISON, WISCONSIN, IN 1875.

1875.	No. of clear days	No. of fair days.	No. of cloudy days.	Actual Barom. red. to 32°.	Mean Thermom.	Mean relative humidity.	Mean cloudiness.	Direc'n of wind.	Force of wind.	Rain or snow.	Highest Temp.	Lowest Temp.	Range.	No. of days when rain or snow fell.	Max. Veloc. of wind.	Barom. Constant.
									Miles.	Inches.	°	°	°		[1]	
January	11	12	8	29.073	3.6	97	4.8	W	7.0[1]	0.90	33	—25	58	11	30	1.080
February	13	6	9	28.955	3.4	83	4.3	W	6.8	2.80	27	—21	48	8	30	1.080
March	11	13	7	28.826	25.1	70	4.4	W	6.0	0.90	64	1	63	5	40	1.060
April	9	12	9	28.882	43.3	68	5.1	NW	7.0	1.87	62	11	51	6	40	1.040
May	14	11	6	28.858	59.0	59	4.0	SW	6.5	2.61	83	31	52	8	30	1.020
June	10	12	8	28.793	64.1	75	4.8	SE	7.5	3.37	80	51	29	7	30	1.010
July	14	13	4	28.955	73.0	71	3.8	SE	6.5	0.97	86	62	24	5	40	1.000
August	15	13	3	28.947	69.6	71	3.2	NW	7.0	2.56	86	52	34	6	40	1.010
September	10	8	12	29.009	58.9	66	5.6	S	6.5	2.06	81	36	45	14	40	1.020
October	6	11	14	28.930	46.1	63	6.3	SW	7.0	1.96	77	27	50	7	30	1.040
November	5	13	12	28.987	31.0	81	6.0	N	7.0	0.40	54	—11	65	6	30	1.070
December	5	14	12	28.794	31.9	87	7.0	NW	7.5	2.18	54	—11	65	7	30	1.080
Sum	123	138	104	....	......	......	......	......	......	22.58	......	......	......	90	Max.	......
Means	10.2	11.5	8.7	28.917	42.42	74.0	4.9	W	6.9[1]	2.88	(86)	(—25)	(111)	......	40	1.043
Percentage	34	38	28	....	......	......	......	......	......	......	......	......	......	......	......	......

[1] Estimated.

OBSERVATIONS AT MADISON, WISCONSIN, IN 1876.

1876.	No. of clear days.	No. of fair days.	No. of cloudy days.	Actual Barom. red. to 32°.	Mean Thermom.	Mean relative humidity.	Mean cloudiness.	Direc'n of wind.	Force of wind.	Rain or snow.	Highest Temp.	Lowest Temp.	Range.	No. of days when rain or snow fell.	Max. Veloc. of wind.	Barom. Constant.
									Miles.	Inches.	°	°	°			
January	10	11	10	28.934	24.5	91	4.0	SW	[1]6.5	2.31	46	— 6	52	8	40	1.080
February	4	18	7	28.934	24.3	91	6.0	S	5.5	1.60	53	—10	63	3	30	1.080
March	5	13	13	28.955	27.8	93	6.0	N	7.0	2.27	58	— 0	58	6	30	1.000
April	7	16	7	28.840	45.5	72	5.0	SE	7.0	2.65	66	30	36	6	30	1.040
May	11	8	12	28.969	59.5	69	4.0	SW	5.2	5.18	83	36	47	16	30	1.020
June	5	13	12	28.801	68.2	77	6.0	SW	6.0	4.57	87	42	45	9	30	1.010
July	10	16	5	28.930	74.5	70	4.0	S	5.5	4.14	89	61	28	8	40	1.000
August	10	15	6	28.960	73.1	72	4.5	S	5.5	3.42	90	56	34	6	40	1.010
September	5	18	7	28.835	59.8	77	4.9	N	9.0	3.41	79	36	43	5	50	1.020
October	13	10	8	28.853	45.8	74	4.4	W	6.0	1.59	66	23	43	2	50	1.040
November	4	9	17	28.929	35.6	84	7.0	NW	5.5	2.31	56	14	42	3	30	1.040
December	7	15	9	29.064	11.1	80	5.3	NW	6.5	2.59	38	—22	60	5	40	1.080
Sum	91	162	113							36.04				77	Max.	
Mean	7.6	13.5	9.4	28.920	45.81	79.2	5.1	SW	[1]6.3	3.00	(90)	(-22)	(112)		(50)	1.043
Percentage	25	44	31													

[1] Estimated.

OBSERVATIONS AT MADISON, WISCONSIN, IN 1877.

1877.	No. of clear days.	No. of fair days.	No. of cloudy days.	Actual Barom. red. to 32°.	Mean Thermom.	Mean relative humidity.	Mean cloudiness.	Direc'n of wind.	Force of wind.[1]	Rain or snow.	Highest Temp.	Lowest Temp.	Range.	No. of days when rain or snow fell.	Max. Veloc. of wind.	Barom. Constant.[1]
									Miles.	Inches.	°	°	°		1	
January	10	12	9	29.067	12.9	87	4.3	SW	5.0	1.00	43	−16	59	2	30	1.080
February	14	6	8	29.108	32.6	86	3.7	N	6.0	0.30	52	15	37	1	30	1.090
March	11	14	6	28.988	23.21	84	4.2	N	6.5	3.40	54	− 2	56	9	30	1.060
April	12	9	9	28.977	45.3	74	4.5	N	4.5	0.00	74	18	56	0	30	1.040
May	15	11	5	28.991	60.7	73	3.9	S	2.3	1.02	83	34	49	3	20	1.020
June	9	18	3	28.866	65.9	74	4.2	S	3.5	4.77	81	47	34	6	30	1.010
July	20	9	2	28.969	73.0	73	3.1	NW	6.5	3.84	88	57	31	7	50	1.000
August	20	9	2	28.970	67.8	69	2.9	NW	7.5	3.76	86	59	27	10	40	1.010
September	17	9	4	28.992	65.8	71	3.0	SW	9.0	0.64	86	47	39	4	40	1.020
October	5	10	16	29.008	51.2	75	6.4	SW	9.5	4.12	79	33	45	10	30	1.040
November	7	6	17	28.990	34.7	77	6.5	SW	7.0	2.81	49	10	39	8	30	1.070
December	6	11	14	29.028	38.7	80	6.3	SW	8.0	2.01	62	16	46	7	40	1.080
Sum	146	124	95							27.67				67	Max.	
Mean	12.2	10.3	7.9	28.996	46.52	77.0	4.4	SW	6.1	2.31	(86)	(−16)	(102)		(50)	1.043
Percentage	40	34	26													

[1] Estimated.

OBSERVATIONS AT MADISON, WISCONSIN, IN 1878.

1878.	No. of clear days.	No. of fair days.	No. of cloudy days.	Actual Barom. red. to 32.°	Mean Thermom.	Mean relative humidity.	Mean cloudiness.	Direc'n of wind.	Force of wind.[1]	Rain or snow.	Highest Temp.	Lowest Temp.	Range.	No. of days when rain or snow fell.	Max. Veloc. of wind.[1]	Barom. Constant.
									Miles.	Inches.	°	°	°			
January	4	15	12	28.966	25.1	90	6.4	NW	8.2	0.40	45	— 9	54	3	30	1.080
February	8	7	13	28.884	32.8	82	5.6	N	8.5	1.19	53	13	40	5	40	1.080
March	9	12	10	28.882	44.0	73	5.4	N	9.1	2.43	69	27	42	9	50	1.060
April	9	9	12	28.720	52.3	67	5.5	SW	10.5	2.97	73	36	37	10	50	1.040
May	5	14	12	28.887	54.6	70	5.8	NW	9.5	4.64	77	41	36	6	40	1.020
June	8	13	9	28.964	65.8	69	4.9	N	9.2	4.20	86	48	38	6	50	1.010
July	11	15	5	28.984	74.9	74	4.5	N	7.5	7.56	92	61	31	11	40	1.000
August	13	15	5	28.907	72.2	71	3.9	NW	7.5	4.28	86	58	28	8	50	1.010
September	14	9	7	29.032	62.9	70	4.0	S	10.2	6.54	85	42	43	5	52	1.020
October	8	12	11	28.959	49.6	68	5.0	NW	12.8	3.78	76	20	56	12	50	1.030
November	11	9	8	29.017	40.2	70	5.0	NW	8.6	0.76	58	24	34	6	25	1.070
December	8	11	12	29.018	22.1	66	5.0	W	10.6	0.79	39	— 8	47	8	29	1.100
Sum	108	141	116	....	......	......	......	......	......	39.54	.....	.....	.....	89	.....	....
Means	9.0	11.7	9.7	28.935	49.7	68.1	5.1	NW	9.3	3.29	(92)	(—9)	(101)	.....	(50)	1.035
Percentage	29	39	32	....	......	......	......	......	......	......	.....	.....	.....	.....	.....	....

[1] To October estimated.

OBSERVATIONS AT MADISON, WISCONSIN, IN 1879.

1879.	No. of clear days.	No. of fair days.	No. of cloudy days.	Actual Barom. red. to 32°.	Mean Thermom.	Mean relative humidity.	Mean cloudiness.	Direc'n of wind.	Force of wind.	Rain or snow.	Highest Temp.	Lowest Temp.	Range.	No. of days when rain or snow fell.	Max. Veloc. of wind.	Barom. Constant.
									Miles	Inches.	°	°	°			
January	5	14	12	29.055	19.7	63.5	4	NW..	9.7	0.79	46	—22	68	8	81	1.090
February	5	16	7	29.043	22.0	70.0	6	NW..	11.6	2.54	46	—12	58	11	80	1.090
March	9	12	10	29.022	36.7	66.3	6	NW..	11.5	1.34	68	5	63	11	40	1.070
April	3	19	8	28.982	48.2	59.3	3	S....	10.5	3.33	82	12	70	6	48	1.040
May	5	20	6	29.000	60.7	60.4	5	SE...	10.0	3.91	86	35	51	9	36	1.000
June	2.	23	5	28.972	67.4	69.6	5	SE...	8.8	2.80	86	42	44	11	24	0.990
July	3	23	5	28.948	74.3	71.3	4	SW..	7.4	5.91	91	55	36	6	32	0.980
August	6	18	7	28.953	70.6	66.8	4	S...	8.1	0.99	90	47	43	10	40	0.980
September	4	8	8	29.046	59.0	70.3	5	S.....	10.1	2.79	78	37	41	13	30	1.000
October	4	17	10	29.069	58.0	67.0	4	S.....	10.4	2.50	84	24	60	9	30	1.080
November	2	10	18	28.994	37.0	73.1	6	NW..	10.9	6.02	67	11	56	18	40	1.070
December	3	11	17	29.005	21.1	73.9	7	W...	10.5	2.81	54	—12	66	15	30	1.100
Sum	51	201	113	....	....	....	.....	......	.....	35.23	.....	.....	.....	122	.....	......
Means	4.2	16.8	9.4	29.010	47.9	67.6	5.0	NW..	9.9	2.94	(91)	(-22)	(118)	.....	(48)	1.087
Percentage	14	55	31	....	....	....	.....	......	.....	......	.....	.....	.....	.....	.....	......

OBSERVATIONS AT MADISON, WISCONSIN, IN 1880.

1880.	No. of clear days.	No. of fair days.	No. of cloudy days.	Actual Barom. red. to 32.	Mean Thermom.	Mean relative humidity.	Mean cloudiness.	Direc'n of wind.	Force of wind.	Rain or snow.	Highest Temp.	Lowest Temp.	Range.	No. of days when rain or snow fell.	Max. Veloc. of wind.	Barom. Constant.
									Miles.	Inches.	°	°	°			
January	3	13	15	28.937	34.5	73.1	5	S	11.7	2.75	58	6	52	13	40	1.090
February	7	11	11	28.936	28.2	70.0	4	NW.	8.3	1.75	55	0	55	9	35	1.090
March	9	12	10	29.006	33.6	67.8	5	W	12.9	2.11	57	7	50	8	35	1.070
April	3	18	9	28.883	46.6	64.6	5	W	13.5	5.48	78	23	55	13	41	1.040
May	5	16	10	28.936	65.5	62.0	5	S	9.8	4.55	86	44	42	15	30	1.000
June	0	21	9	28.924	69.6	71.4	5	SW.	8.4	9.31	87	50	37	16	50	0.990
July	1	21	9	28.981	71.9	71.6	5	NW.	7.1	6.00	93	53	40	13	25	0.980
August	4	15	12	29.012	71.0	74.1	6	S	7.6	5.90	92	52	40	13	30	0.980
September	4	20	6	29.031	60.6	70.9	4	S	8.4	4.44	85	40	45	11	30	1.000
October	8	13	10	29.011	48.5	66.8	5	S	10.8	1.68	75	26	49	6	44	1.030
November	4	15	11	29.083	26.8	72.0	6	W	10.9	1.68	60	−7	67	12	28	1.070
December	5	7	19	29.036	17.0	74.7	7	W	9.9	1.17	40	−21	61	19	32	1.100
Sum	53	182	131	....	....	....	62	....	....	46.72	....	....	....	148	Max.	....
Mean	4.4	15.1	10.9	28.980	47.8	69.9	5.2	S	9.9	3.89	(93)	(−21)	(114)	(12)	(50)	1.037
Percentage	14	50	36	....	....	....	....	....	....	....	....	....	....	....	....	....

OBSERVATIONS AT MADISON, WISCONSIN, IN 1873.

1873.	No. of clear days.	No. of fair days.	No. of cloudy days.	Actual Barom. red. to 32°.	Mean Thermom.	Mean relative humidity.	Mean Cloudiness.	Direc'n of wind.	Force of wind.	Rain or snow.	Highest Temp.	Lowest Temp.	Range.	No. of days when rain or snow fell.	Max. Veloc. of wind.	Barom. Constant.
									Miles.	Inches.	°	°	°		[1]	
January	5	12	14	28.850	10.9	98	6.8	N....	9.0	1.40	38	—21	59	8	50	1 080
February	12	10	6	28.857	15.6	95	3.6	W ...	5.5	0.60	40	—20	60	1	30	1.080
March	10	14	7	28.886	30.8	75	4.5	NW..	8.8	2.07	52	— 5	57	6	40	1.060
April	4	14	12	28.801	43.4	66	6.5	NW..	5.2	1.26	80	29	51	4	40	1.040
May	10	12	9	28.842	55.2	66	5.1	E	6.5	3.53	76	39	37	8	40	1.020
June	15	13	2	28.862	73.0	68	2.8	SW..	5.5	5.60	89	55	34	8	40	1.010
July	14	15	2	28.928	71.7	68	4.5	W ...	6.0	0.82	91	53	38	5	30	1.000
August	10	12	3	28.957	71.9	69	3.2	SW..	5.0	2.76	91	58	33	5	50	1.010
September	14	11	5	28.930	55.4	67	3.6	NW..	8.5	2.54	87	40	47	7	40	1.020
October	14	7	10	28.914	45.1	68	4.7	SW..	8.5	1.96	73	20	53	6	40	1.040
November	5	14	11	28.886	28.2	85	5.9	NW..	8.0	2.15	50	2	48	7	40	1.070
December	5	11	15	28.998	26.0	88	5.9	SE...	7.0	1.80	43	2	41	6	40	1.080
Sum	124	145	96	....	......	......	.....	......	.....	26.49	.....	.....	.....	71	Max.	......
Means	10.3	12.1	8.0	28.893	43.8	76.1	4.8	NW..	6.9	2.21	(91)	(−21)	(112)	.....	(50)	1.043
Percentage	34	40	26	....	......	......	.....	......	.....	......	.....	.....	.....	.....	.....	......

[1] Estimated.

Observations at Madison, Wisconsin, in 1874.

1874.	No. of clear days.	No. of fair days.	No. of cloudy days.	Actual Barom. red. to 32.°	Mean Thermom.	Mean relative humidity.	Mean cloudiness.	Direc'n of wind.	Force of wind.	Rain or snow.	Highest Temp.	Lowest Temp.	Range.	No. of days when rain or snow fell.	Max. Veloc. of wind.	Barom. Constant.
									Miles.	Inches.	°	°	°		[1]	
January	6	10	9	28.978	18.9	90	5.8	SW	7.0	3.64	57	−12	69	9	40	1.080
February	11	9	8	28.995	21.0	91	4.5	SW	5.5	0.95	41	−10	51	3	30	1.080
March	11	12	8	28.935	29.7	69	4.4	W	6.0	0.95	56	10	46	3	40	1.060
April	10	15	5	29.031	36.8	66	4.0	NE	6.5	1.26	63	13	50	5	40	1.040
May	15	8	8	28.893	59.4	67	4.1	NE	6.0	2.14	90	42	48	7	40	1.020
June	10	13	7	28.878	63.3	78	4.2	SW	6.0	2.85	92	54	38	8	50	1.010
July	20	8	3	28.967	75.4	63	2.5	SW	9.0	5.19	96	62	34	5	40	1.000
August	9	16	6	28.970	71.1	65	4.2	NE	8.5	1.40	93	58	35	6	30	1.010
September	15	8	7	28.961	64.4	73	4.0	SW	9.5	5.46	90	46	44	11	40	1.020
October	12	10	9	28.848	51.0	76	4.8	SE	6.0	1.44	71	30	41	4	30	1.040
November	10	14	6	28.970	32.6	77	4.4	W	8.0	3.29	69	−3	72	8	40	1.070
December	3	19	9	28.977	22.6	84	5.9	NW	8.3	0.45	50	−15	65	5	30	1.030
Sum	132	148	85							29.02				74	Max.	
Means	11.0	12.3	7.1	28.952	45.8	74.9	4.4	SW	7.2	2.42	(96)	(−15)	(111)		(50)	1.043
Percentage	36	41	28													

[1] Estimated.

Observations at Madison, Wisconsin, in 1875.

1875.	No. of clear days	No. of fair days.	No. of cloudy days.	Actual Barom. red. to 32°.	Mean Thermom.	Mean relative humidity.	Mean cloudiness.	Direc'n of wind.	Force of wind.	Rain or snow.	Highest Temp.	Lowest Temp.	Range.	No. of days when rain or snow fell.	Max. Veloc. of wind.	Barom. Constant.
									Miles.	Inches.	°	°	°		[1]	
January	11	12	8	29.073	3.6	97	4.8	W	7.0[1]	0.90	33	—25	58	11	30	1.080
February	13	6	9	28.955	3.4	83	4.3	W	6.8	2.80	27	—21	48	8	30	1.080
March	11	13	7	28.826	25.1	70	4.4	W	6.0	0.90	64	1	63	5	40	1.060
April	9	12	9	28.882	43.3	68	5.1	NW	7.0	1.87	62	11	51	6	40	1.040
May	14	11	6	28.858	59.0	59	4.0	SW	6.5	2.61	83	31	52	8	30	1.020
June	10	12	8	28.793	64.1	75	4.8	SE	7.5	3.37	80	51	29	7	30	1.010
July	14	13	4	28.955	73.0	71	3.8	SE	6.5	0.97	86	62	24	5	40	1.000
August	15	13	3	28.947	69.6	71	3.2	NW	7.0	2.56	86	52	34	6	40	1.010
September	10	8	12	29.009	58.9	66	5.6	S	6.5	2.06	81	36	45	14	40	1.020
October	6	11	14	28.930	46.1	63	6.3	SW	7.0	1.96	77	27	50	7	30	1.040
November	5	13	12	28.987	31.0	81	6.0	N	7.0	0.40	54	—11	65	6	30	1.070
December	5	14	12	28.794	31.9	87	7.0	NW	7.5	2.18	54	—11	65	7	30	1.080
Sum	123	138	104	....	.....	.....	.....	.....	.....	22.58	.....	.....	.....	90	Max.	.....
Means	10.2	11.5	8.7	28.917	42.42	74.0	4.9	W	6.9[1]	2.88	(86)	(—25)	(111)	.....	40	1.043
Percentage	34	38	28	....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....

[1] Estimated.

OBSERVATIONS AT MADISON, WISCONSIN, IN 1876.

1876.	No. of clear days.	No. of fair days.	No. of cloudy days.	Actual Barom. red. to 32°.	Mean Thermom.	Mean relative humidity.	Mean cloudiness.	Direc'n of wind.	Force of wind.	Rain or snow.	Highest Temp.	Lowest Temp.	Range.	No. of days when rain or snow fell.	Max. Veloc. of wind.	Barom. Constant.
									Miles.	Inches.	°	°	°			
January	10	11	10	28.934	24.5	91	4.0	SW	[1]6.5	2.31	46	−6	52	8	40	1.080
February	4	18	7	28.934	24.3	91	6.0	S	5.5	1.60	53	−10	63	3	30	1.080
March	5	13	13	28.955	27.8	93	6.0	N	7.0	2.27	58	−0	58	6	30	1.000
April	7	16	7	28.840	45.5	72	5.0	SE	7.0	2.65	66	30	36	6	30	1.040
May	11	8	12	28.969	59.5	69	4.0	SW	5.2	5.18	83	36	47	16	30	1.020
June	5	13	13	28.801	68.2	77	6.0	SW	6.0	4.57	87	42	45	9	30	1.010
July	10	16	5	28.930	74.5	70	4.0	S	5.5	4.14	89	61	28	8	40	1.000
August	10	15	6	28.960	73.1	72	4.5	S	5.5	3.42	90	56	34	6	40	1.010
September	5	18	7	28.835	59.8	77	4.9	N	9.0	3.41	79	36	43	5	50	1.020
October	13	10	8	28.853	45.8	74	4.4	W	6.0	1.59	66	23	43	2	50	1.040
November	4	9	17	28.929	35.6	84	7.0	NW	5.5	2.31	56	14	42	3	30	1.040
December	7	15	9	29.064	11.1	80	5.3	NW	6.5	2.59	38	−22	60	5	40	1.080
Sum	91	162	113	....	......	.....	......	......	......	36.04	....	.....	.....	77	Max.	....
Mean	7.6	13.5	9.4	28.920	45.81	79.2	5.1	SW	[1]6.3	3.00	(90)	(−22)	(112)	.....	(50)	1.043
Percentage	25	44	31	....	......	.....	......	......	......	....	....	.....	.....	.....	....	....

[1] Estimated.

Observations at Madison, Wisconsin, in 1877.

1877.	No. of clear days.	No. of fair days.	No. of cloudy days.	Actual Barom. red. to 32°.	Mean Thermom.	Mean relative humidity.	Mean cloudiness.	Direc'n of wind.	Force of wind.[1]	Rain or snow.	Highest Temp.	Lowest Temp.	Range.	No. of days when rain or snow fell.	Max. Veloc. of wind.	Barom. Constant.[1]
									Miles.	Inches.	°	°	°		1	
January	10	12	9	29.067	12.9	87	4.3	SW	5.0	1.00	43	−16	59	2	30	1.080
February	14	6	8	29.108	32.6	86	3.7	N	6.0	0.30	52	15	37	1	30	1.090
March	11	14	6	28.988	23.21	84	4.2	N	6.5	3.40	54	−2	56	9	30	1.060
April	12	9	9	28.977	45.3	74	4.5	N	4.5	0.00	74	18	56	0	30	1.040
May	15	11	5	28.991	60.7	73	3.9	S	2.8	1.02	83	34	49	8	20	1.020
June	9	18	3	28.866	65.9	74	4.2	S	3.5	4.77	81	47	34	6	30	1.010
July	20	9	2	28.969	73.0	73	3.1	NW	6.5	3.84	88	57	31	7	50	1.000
August	20	9	2	28.970	67.8	69	2.9	NW	7.5	3.76	86	59	27	10	40	1.010
September	17	9	4	28.992	65.8	71	3.0	SW	9.0	0.64	86	47	39	4	40	1.020
October	5	10	16	29.008	51.2	75	6.4	SW	9.5	4.12	79	33	45	10	30	1.040
November	7	6	17	28.990	34.7	77	6.5	SW	7.0	2.81	49	10	39	8	30	1.070
December	6	11	14	29.028	38.7	80	6.3	SW	8.0	2.01	62	16	46	7	40	1.080
Sum	146	124	95	....	....	....	......	......	......	27.67	......	......	......	67	Max.	......
Mean	12.2	10.8	7.9	28.996	46.52	77.0	4.4	SW	6.1	2.31	(86)	(−16)	(102)	.....	(50)	1.043
Percentage	40	34	26	....	....	....	......	......	......	....	......	......	......	......	......	......

[1] Estimated.

OBSERVATIONS AT MADISON, WISCONSIN, IN 1878.

1878.	No. of clear days.	No. of fair days.	No. of cloudy days.	Actual Barom. red. to 32.°	Mean Thermom.	Mean relative humidity.	Mean cloudiness.	Direc'n of wind.	Force of wind.	Rain or snow.	Highest Temp.	Lowest Temp.	Range.	No. of days when rain or snow fell.	Max. Veloc. of wind.	Barom. Constant.
									Miles.[1]	Inches.	°	°	°		[1]	
January	4	15	12	28.966	25.1	90	6.4	NW	8.2	0.40	45	−9	54	3	30	1.080
February	8	7	13	28.884	32.8	82	5.6	N	8.5	1.19	53	13	40	5	40	1.080
March	9	12	10	28.882	44.0	73	5.4	N	9.1	2.43	69	27	42	9	50	1.060
April	9	9	12	28.720	52.3	67	5.5	SW	10.5	2.97	73	36	37	10	50	1.040
May	5	14	12	28.887	54.6	70	5.8	NW	9.5	4.64	77	41	36	6	40	1.020
June	8	13	9	28.964	65.8	69	4.9	N	9.2	4.20	86	48	38	6	50	1.010
July	11	15	5	28.984	74.9	74	4.5	N	7.5	7.56	92	61	31	11	40	1.000
August	13	15	5	28.907	72.2	71	3.9	NW	7.5	4.28	86	58	28	8	50	1.010
September	14	9	7	29.032	62.9	70	4.0	S	10.2	6.54	85	42	43	5	52	1.020
October	8	12	11	28.959	49.6	68	5.0	NW	12.8	3.78	76	20	56	12	50	1.030
November	11	9	8	29.017	40.2	70	5.0	NW	8.6	0.76	58	24	34	6	25	1.070
December	8	11	12	29.018	22.1	66	5.0	W	10.6	0.79	39	−8	47	8	29	1.100
Sum	108	141	116	....	......	......	......	......	......	39.54	....	....	....	89	.....	....
Means	9.0	11.7	9.7	28.935	49.7	68.1	5.1	NW	9.3	3.29	(92)	(−9)	(101)	.....	(50)	1.035
Percentage	29	39	32	....	......	......	......	......	......	....	....	....	....	.....	.....	....

[1] To October estimated.

OBSERVATIONS AT MADISON, WISCONSIN, IN 1879.

1879.	No. of clear days.	No. of fair days.	No. of cloudy days.	Actual Barom. red. to 32°.	Mean Thermom.	Mean relative humidity.	Mean cloudiness.	Direc'n of wind.	Force of wind.	Rain or snow.	Highest Temp.	Lowest Temp.	Range.	No. of days when rain or snow fell.	Max. Veloc. of wind.	Barom. Constant.
									Miles	Inches.	°	°	°			
January..........	5	14	12	29.055	19.7	63.5	4	NW..	9.7	0.79	46	—22	68	8	31	1.090
February..........	5	16	7	29.042	22.0	70.0	6	NW..	11.6	2.54	46	—12	58	11	30	1.090
March	9	12	10	29.022	36.7	66.3	6	NW..	11.5	1.34	68	5	63	11	40	1.070
April	3	19	8	28.982	48.2	59.3	3	S	10.5	3.33	82	12	70	6	48	1.040
May	5	20	6	29.000	60 7	60.4	5	SE...	10.0	3.91	86	35	51	9	36	1.000
June	2.	23	5	28.972	67.4	69 6	5	SE...	8.3	2.80	86	42	44	11	24	0.990
July	3	23	5	28.948	74.3	71.3	4	SW ..	7.4	5.91	91	55	36	6	32	0.980
August	6	18	7	28.953	70.6	66.8	4	S ...	8.1	0.99	90	47	43	10	40	0.980
September..........	4	8	8	29.046	59.0	70.3	5	S.....	10.1	2.79	78	37	41	13	30	1.(00
October	4	17	10	29.069	58.0	67.0	4	S.....	10.4	2.50	84	24	60	9	30	1.030
November..........	2	10	18	28.994	37.0	73.1	6	NW..	10.9	6.02	67	11	56	13	40	1.070
December	3	11	17	29.005	21.1	73.9	7	W ...	10.5	2.31	54	—12	66	15	30	1.100
Sum	51	201	113	....	....	....	.....	......	......	35.23	.....	.....	.....	122	.....	......
Means	4.2	16.8	9.4	29.010	47.9	67.6	5.0	NW..	9.9	2.94	(91)	(-22)	(113)	.....	(48)	1.037
Percentage..........	14	55	31	....	....	....	.....	......	......	......	.....	.....	.....	.....	.....	......

OBSERVATIONS AT MADISON, WISCONSIN, IN 1880.

1880.	No. of clear days.	No. of fair days.	No. of cloudy days.	Actual Barom. red. to 32.	Mean Thermom.	Mean relative humidity.	Mean cloudiness.	Direc'n of wind.	Force of wind.	Rain or snow.	Highest Temp.	Lowest Temp.	Range.	No. of days when rain or snow fell.	Max. Veloc. of wind.	Barom. Constant.
									Miles.	Inches.	°	°	°			
January	3	13	15	28.937	34.5	73.1	5	S	11.7	2.75	58	6	52	13	40	1.090
February	7	11	11	28.936	28.2	70.0	4	NW.	8.3	1.75	55	0	55	9	35	1.090
March	9	12	10	29.006	33.6	67.8	5	W	12.9	2.11	57	7	50	8	35	1.070
April	3	18	9	28.883	46.6	64.6	5	W	13.5	5.48	78	23	55	13	41	1.040
May	5	16	10	28.936	65.5	62.0	5	S	9.8	4.55	86	44	42	15	30	1.000
June	0	21	9	28.924	69.6	71.4	5	SW	8.4	9.31	87	50	37	16	50	0.990
July	1	21	9	28.981	71.9	71.6	5	NW.	7.1	6.00	93	53	40	18	25	0.980
August	4	15	12	29.012	71.0	74.1	6	S	7.6	5.90	92	52	40	13	30	0.980
September	4	20	6	29.031	60.6	70.9	4	S	8.4	4.44	85	40	45	11	30	1.000
October	8	13	10	29.011	48.5	66.8	5	S	10.8	1.68	75	26	49	6	44	1.030
November	4	15	11	29.083	26.8	72.0	6	W	10.9	1.68	60	−7	67	12	28	1.070
December	5	7	19	29.036	17.0	74.7	7	W	9.9	1.17	40	−21	61	19	32	1.100
Sum	53	182	131	....	......	......	62	......	......	46.72	.....	.....	.....	148	Max.	....
Mean	4.4	15.1	10.9	28.980	47.8	69.9	5.2	S	9.9	3.89	(93)	(−21)	(114)	(12)	(50)	1.037
Percentage	14	50	36	....	......	......	......	......	......	......	.....	.....	.....	.....	.....	....